

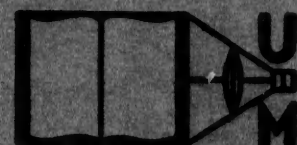
Vol. XV

No. 1

DISSERTATION ABSTRACTS

*A GUIDE TO DISSERTATIONS AND
MONOGRAPHS AVAILABLE IN MICROFORM*

UNIVERSITY MICROFILMS
ANN ARBOR, MICHIGAN: 1955



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TABLE OF CONTENTS

The Table of Contents lists in alphabetical order the principal subject headings of the dissertations abstracted. For the convenience of readers an alphabetical author index is included following the abstracts.

AGRICULTURE	1
ANATOMY	11
BIOLOGY - GENETICS	12
BOTANY	13
CHEMISTRY	22
ECONOMICS	51
EDUCATION	60
ENGINEERING	94
FOOD TECHNOLOGY	105
GEOLOGY	106
HEALTH SCIENCES	107
HISTORY	108
HOME ECONOMICS	114
JOURNALISM	115
LANGUAGE AND LITERATURE	118
MATHEMATICS	129
MUSIC	130
PHARMACOLOGY	132
PHILOSOPHY	135
PHYSICS	137
PHYSIOLOGY	142
POLITICAL SCIENCE	145
PSYCHOLOGY	147

SOCIAL PSYCHOLOGY	156
SOCIOLOGY	158
SPEECH - THEATER	164
ZOOLOGY	172
AUTHOR INDEX	177

AGRICULTURE

AGRICULTURE, GENERAL

THE BASES OF RIGIDITY IN FRAGIPANS

(Publication No. 10,592)

Ellis Gilbert Knox, Ph.D.
Cornell University, 1954

This investigation was undertaken to determine what materials or mechanisms are responsible for the strength of fragipans, which are soil horizons with unusual resistance to deformation. Field studies suggested the hypothesis that intergranular bridges of gel-like material hold the sand and silt particles of these horizons together. A study of literature of many fields indicated that chemical and molecular forces are responsible for the strength and coherence of most other kinds of aggregates. The probable contribution of the surface tension of intergranular water to strength was calculated, and except in aggregates of very fine particles was found to be small compared to the strength of soils and soil-like materials. The literature indicated that colloidal material, especially silicate clays, is a probable binding material for fragipans.

Four relatively sandy fragipans from Orange County, New York soils were chosen for study, partly on the basis of adaptation to microscopic examination. Use of the binocular microscope revealed coatings and intergranular bridges of very fine-grained material which was identified as illite with the petrographic microscope. No evidence of mechanical interlocking was found. X-ray diffraction of the very fine-grained material verified its identification as illite.

Experiments based on the selective removal of possible bonding materials with chemical reagents showed that (1) removal of silica gels and the hydrous oxides of iron and aluminum had little effect on the wet strength and stability of clods from the two fragipans representing the typical condition, (2) clods from these fragipans disintegrated after treatment to disperse clay, (3) removal of colloidal silica or the hydrous oxides of iron and aluminum or treatment to disperse clay had little effect on the dry strength of clods from an extreme pan, (4) removal of illite and the hydrous oxides substantially weakened clods from the extreme pan, (5) removal of colloidal silica from clods from which illite and the hydrous oxides had been removed made these clods disintegrate. Neither removal of water nor destruction of organic matter by heating weakened clods.

Artificial briquets made from crushed fragipan material by treatments that dispersed clay were about one half as strong as natural clods from the same pan. Treatments which did not disperse clay resulted in much weaker briquets. It was shown that fragipans typically have high bulk density.

It was concluded that (1) the major part of the strength of the typical fragipans is due to illite, (2) a large part of the strength of the extreme pan is due to illite, and (3) some of the strength of the extreme pan is also due to colloidal silica. It was suggested that the greater strength of fragipans relative to other soil horizons that also contain illite is due to high bulk density, lack of effective structure, and special distribution of clay.

76 pages. \$1.00. MicA 55-1

QUANTITATIVE DETERMINATION OF ANTIBIOTICS IN MILK

(Publication No. 10,432)

Leonard Robert Mattick, Ph.D.
University of Connecticut, 1954

During the past few years, antibiotics have been successfully used for the treatment of bovine mastitis. A consequence of the use of antibiotics is the adverse effect of using the milk from antibiotic-treated cows in the manufacture of milk products requiring acid production.

Several qualitative methods for the detection of antibiotics in milk are available, but they require a great deal of time and do not always detect the lower concentrations which could prove detrimental to fermentative processes.

The method described for the quantitative determination of antibiotics in milk is based on the ability of the antibiotics to inhibit the reduction of nitrate to nitrite by an actively growing culture of *Micrococcus pyogenes* var. *aureus*. The decreased nitrite production, as compared to a control, can be measured colorimetrically following diazotization of sulfanilic acid and coupling with alpha naphthylamine hydrochloride.

This study dealt with an investigation of the applicability of this method to the quantitative determination of antibiotics in milk and the effect of these antibiotics on the acid production of an actively growing starter culture. The antibiotics used in the investigation were penicillin, aureomycin, streptomycin, terramycin, and bacitracin. These antibiotics were chosen because they represented a wide range in activity. This group consisted of a very active antibiotic (penicillin), 3 antibiotics of "intermediate" activity (aureomycin, streptomycin and terramycin), and an antibiotic of "passive" activity (bacitracin).

The test, when used as an quantitative determination for penicillin in milk, accurately detected concentrations as low as 0.1 Oxford unit per milliliter. It was observed that complete inhibition of the starter

culture occurred at 0.5 Oxford unit of penicillin per milliliter. This concentration is within the range accurately detected by the method.

When the calibration curve of aureomycin was calculated, the method appeared to be able to detect the concentrations of aureomycin over the entire range investigated (0 - 3.0 micrograms per milliliter). The method could accurately detect concentrations as low as 0.1 microgram of aureomycin per milliliter. However, the curvature of the regression curve in the higher concentrations was more gradual than the calibration curve fitted to the data obtained in the quantitative determination of penicillin. This indicated that the method would probably be more accurate for aureomycin in the concentrations lower than 2.0 micrograms per milliliter. The amount of aureomycin necessary for complete inhibition of the lactic acid starter was found to be 0.5 microgram per milliliter. This concentration is within the accuracy of the method.

The curve derived from the data obtained in the quantitative analysis of streptomycin in milk resembled very closely the curve fitted to the data of aureomycin. Again the gradual curvation appeared to indicate that the method would be accurate in the concentrations higher than 1.0 microgram of streptomycin per milliliter. However, the method would be much more accurate in the concentrations lower than 1.0 microgram per milliliter than in the concentrations higher than 1.0 microgram per milliliter. The first sign of slight acid inhibition occurred at 0.2 microgram per milliliter. At this concentration, little difficulty should be encountered in the manufacture of cottage cheese. The acidity in the concentrations higher than 0.2 microgram per milliliter decreased gradually until complete inhibition was noted at 1.0 microgram per milliliter.

The curve fitted to the data obtained for terramycin also resembled the regression curves of aureomycin and streptomycin. A gradual curvation occurred rather than the sharp curvature of the curve calculated for penicillin. The method could be used to determine the concentrations of terramycin over the range investigated (0 - 3.0 micrograms of terramycin per milliliter). When the decrease in acid production was correlated with the concentration of terramycin, 0.1 microgram per milliliter caused slight inhibition of the acid producing organism. The acid production gradually decreased until it was completely attenuated at 0.9 microgram of terramycin per milliliter.

The calibration curve of bacitracin showed that the action of this antibiotic on the organism *M. pyogenes* var. *aureus* appeared to be weaker than the other antibiotics studied. A curve was fitted to the data of the experiment. The milk had to contain 10 units of bacitracin per milliliter before the acid production was completely inhibited. However, the calibration curve showed that this concentration could accurately be detected by the test.

The calibration curves for all 5 antibiotics showed a tendency to lose their curvature and become flat in the higher concentrations. This tends to indicate that at the higher concentrations a slight error in the standardized value would incur a large error in the

concentration of the antibiotic. For accurate results in the quantitative determination of the higher concentrations of antibiotics, it would be advisable to make a series of dilutions of the suspected milk. This will place the higher concentrations of the antibiotics within the accurate range of the test. Then, by subjecting all the dilutions to the test, the concentration of the antibiotic in the original sample could be determined by multiplying the concentration of the diluted sample that is in the accurate range by the dilution factor. Using this method, the higher concentrations of antibiotics could be determined.

When a large Connecticut milk plant used the test to determine the presence of antibiotics and used only milk free from antibiotics, the dairy was able to produce cottage cheese every day. Previously the loss averaged a batch of cottage cheese per day. This test could be used as a "screening" test by a dairy plant producing cheese to separate the milk containing antibiotics from the milk containing no antibiotics.

It was concluded that the test was capable of determining the concentration of any antibiotic, since the antibiotics used in this investigation consisted of a very active antibiotic, 3 antibiotics of "intermediate" activity, and an antibiotic of "passive" activity. When the test was applied to the antibiotics, which represented three stages of antibiotic activity, a very good correlation was obtained between the standardized value and the concentration of the antibiotic which caused complete inhibition of *Streptococcus lactis*.

102 pages. \$1.28. MicA 55-2

ZINC SORPTION AND RELEASE BY SOILS AND CLAYS

(Publication No. 10,527)

Jack Loren Nelson, Ph.D.
University of Illinois, 1954

The chemistry of zinc added to various soils and clays has been investigated. The isotope dilution technique, with zinc⁶⁵ as a tracer, was used. After a specific equilibrium period of zinc solution and soil, the added zinc was extracted by successive leaching with neutral normal ammonium acetate, 2.5% acetic acid, and 0.1 normal hydrochloric acid. Variables in the study were: (1) type of clay mineral, (2) base saturation or pH, (3) time of equilibrium, (4) rate of extraction of zinc, and (5) amount of zinc added.

Practically all of the zinc taken up by the soil from symmetry additions was replaceable with ammonium acetate in hydrogen soil systems, while in calcium soil systems, a part of the zinc could not be replaced with ammonium acetate. The portion of the zinc that could not be removed with ammonium acetate was extracted with successive leachings of 0.1 normal hydrochloric acid.

The acid-soluble form of zinc increased in amount with increasing time of contact between the

soil and the zinc solution. As smaller quantities of zinc were added, a higher proportion of the zinc was found in the acid-soluble form.

The acid-soluble form appeared to be an independent form of zinc, since it did not occupy exchange sites of the soil. This was shown in two ways: (1) the retention of the acid-soluble form of zinc in the soil did not decrease the base exchange capacity of the soils used, (2) the calcium released by zinc sorption corresponded to the exchangeable zinc taken up and not to the total amount of zinc sorbed by the soil.

62 pages. \$1.00. MicA 55-3

AGRICULTURE, ANIMAL CULTURE

THE UTILIZATION OF VARIED SULFUR SOURCES IN UREA CONTAINING RATIONS FED TO LAMBS

(Publication No. 10,441)

Waco Worthy Albert, Ph.D.
University of Illinois, 1954

Two studies were made of urea as a nitrogen supplement to a wintering roughage of corn silage fed to lambs. Addition of elemental sulfur to urea supplements was also studied. Supplements were formulated to be equal in energy and nitrogen to 0.25 pound of 44 percent soybean oil meal and also contained sulfur free, trace mineralized salt and dicalcium phosphate. A third study was designed to determine the sulfur requirement of growing-fattening lambs fed rations containing urea.

During the winter of 1951-52 four lots of lambs were fed daily five pounds of corn silage per lamb plus a nitrogen supplement. One lot received 0.25 pound of soybean oil meal daily per lamb. A second lot received a supplement wherein urea replaced two-thirds of the protein of 0.25 pound of soybean oil meal. Each lot 3 lamb received daily the same urea supplement as lot 2 plus 5 grams of elemental sulfur. Each lot 4 lamb received daily twice the amount of urea as lambs of lots 2 or 3 plus 5 grams of elemental sulfur. Cerelese was used as energy in the urea supplements. Average daily gains in pounds per lamb for 131 days: soybean 0.137; urea 0.115; urea-sulfur 0.138; 2x urea-sulfur 0.141. Gains were not statistically different, $P=0.07$. Average wool yields of lots 1, 3 and 4 were significantly greater than that of the urea lot. Wool yields between lots 1, 3 and 4 were not statistically different.

In the 1952-53 study urea supplements were formulated without soybean oil meal. Equal parts of starch and cerelese were used as the energy in two supplements, while cracked yellow corn served as the energy source in two supplements. The 131-day study included a 37-day lot feeding period of corn silage and a urea-starch-cerelese supplement followed by a 56-day individual feeding of regular preserved

silage and supplements. The last 28 days each lamb was individually fed SO_2 treated silage plus supplement. An analysis of gains of the 56-day feeding period showed that soybean oil meal lambs made highly significantly greater gains than urea-supplemented lambs; 0.2 percent elemental sulfur in urea rations increased lamb gains significantly. Ground corn as an energy source improved lamb gains, ($P=.01$). Upon feeding of SO_2 silage previous statistical differences in lamb gains were erased. Nitrogen retention of urea-cerelese-starch supplemented lambs during the 56-day period was the smallest but improved upon feeding of SO_2 silage. Wool yields were not significantly different.

In the third study five graded levels of each of elemental sulfur, sodium sulfate, and methionine were added to a basal ration containing 4 percent urea and analyzing 0.048 percent total sulfur. Gain data from a 56-day individual lamb feeding trial from the various levels of the different sulfur sources fitted a quadratic curve. Statistical analysis showed the sulfur requirement of a growing-fattening lamb to be approximately 0.471, 1.76, and 0.638 percent of the ration for elemental sulfur, sulfate and methionine respectively. No off-flavor from high urea feeding was noted in the lean or fat from the lambs.

128 pages. \$1.60. MicA 55-4

NICOTINIC ACID AND TRYPTOPHAN METABOLISM IN THE CHICK

(Publication No. 10,474)

Hans Fisher, Ph.D.
University of Illinois, 1954

A method has been devised that permits the quantitative collection of pure urine, separately from the feces, in growing chicks. By means of this method, urinary metabolites of nicotinic acid were studied with the use of radioactive nicotinic acid. The major metabolites under these conditions were found to be nicotinic acid itself and its amide.

In a series of factorially designed experiments, the niacin and tryptophan requirement of the chick were determined, as well as the influence of certain amino acids and of corn on this requirement. It was found under a variety of conditions that the L-tryptophan requirement was always met by 0.15% of the diet. At this minimal tryptophan level, the niacin requirement ranged from 2.5 to 10 mg % depending on the presence of certain stress factors. In the absence of stress factors as little as 0.20% L-tryptophan completely spared the niacin requirement, with higher amounts necessary in the presence of supplemental amino acids or of corn. Small amounts of histidine, leucine and threonine increased the niacin requirements for the prevention of perosis. The effect of corn was very similar to that induced by the amino acid supplementation and appears to be due to its amino acid composition rather than to any toxic principle in corn. The influence of amino acids on

the niacin requirement appears to be a direct involvement of niacin rather than an indirect one through tryptophan. Practical soybean or fishmeal chick starting rations were found to be adequate in tryptophan and niacin without further supplementation.

There is no correlation between liver pyridine nucleotide level and growth rate. At normal dietary levels of tryptophan and niacin, the former contributes more to the storage of pyridine nucleotides in the liver. At equimolar levels of feeding, niacin is more efficient than tryptophan in increasing the storage of liver pyridine nucleotides. This is the first study involving criteria other than growth in which a conversion of tryptophan to niacin has been shown in the chick.

Under the conditions of our experiments, glycine did not depress growth when added at 4% to diets already containing at least 1-1.5%. Instead, it significantly improved feed utilization, a phenomenon which decreased with advancing age of the birds. This better efficiency could be explained by significant increases in the percentage of feathers and muscle creatine levels in the glycine supplemented chicks. The importance of glycine for creatine synthesis is accentuated by the fact that the muscle creatine content in early chick life is extremely low. The rise in muscle creatine content with age may be related to the decreasing difference in feed utilization due to glycine supplementation.

78 pages. \$1.00. MicA 55-5

UNIDENTIFIED FACTORS IN SWINE NUTRITION

(Publication No. 10,479)

Don Irvin Gard, Ph.D.
University of Illinois, 1954

A semi-purified (fortified cornstarch-isolated soybean protein) diet was developed for comparing sources of unidentified factors and for use in studying the nutrient requirements of swine, especially during gestation and lactation. Gestation-lactation performance of sows fed a semi-purified control diet or this diet supplemented with 10 per cent dehydrated alfalfa meal was compared in 3 experiments. Eighty-eight per cent of the alfalfa-fed sows weaned litters as compared to 56 per cent of the control sows. After the sows had been on the diets 233 days 29 per cent fewer services per conception were required by the alfalfa-fed sows as compared to the control sows. Alfalfa-fed sows farrowed stronger and 0.8 more live pigs, weaned 0.7 more pigs but a lower percentage of their pigs as compared to the control sows. Control sows weaned heavier pigs but alfalfa-fed sows weaned (non-significantly) heavier litters. After 448 days the 2 groups showed no difference in ovulatory rate or number of abnormalities of the reproductive tract. Sows fed the control diet plus 3 per cent fish solubles farrowed more pigs and fewer stillborn pigs, weaned heavier pigs, had a higher percentage survival and required 10 per cent less feed

per 100 pounds total gain than the control sows. Creep feed data indicated that 3 per cent fish solubles increased feed consumption; whereas, 10 per cent dehydrated alfalfa meal decreased feed consumption.

A total of 188 weanling pigs was used in a series of randomized-block factorial experiments to test dehydrated alfalfa meal, menhaden fish solubles, a grass juice concentrate, dried brewers' yeast, a dried whey product with whey fermentation solubles, a streptomycin residue and a "vitamin B₁₃" concentrate as possible sources of unidentified growth factors. The pigs were randomized to the treatments from litter outcome groups. Both the semi-purified and practical diets were equalized for crude protein except in the first experiment where the isolated soybean protein was equalized. Covariance analyses were made with final weights adjusted for differences in initial weight. Final weights were also adjusted for differences in feed consumption in the 3 factorial experiments where individual feed data were available. Three per cent grass juice concentrate produced a significant growth response but when feed consumption data were considered this response was not quite significant. The interactions of grass juice concentrate with dried whey and of fish solubles with dried whey were not significant when feed consumption was taken into consideration. This agrees with the idea that these ingredients affected the voluntary feed intake (and the analyses of feed consumption indicate this also), and possibly grass juice concentrate may be supplying an unidentified growth factor. Dehydrated alfalfa meal at the 10 per cent level depressed growth. The fiber contribution of the alfalfa meal was not the primary factor involved, since a crude fiber equivalent did not depress growth. Three per cent of a streptomycin residue depressed growth and feed efficiency in a semi-purified diet but at the 1.8 per cent level it promoted growth on a practical diet. "Vitamin B₁₃" concentrate added to a semi-purified diet had no effect on growth or feed conversion.

Grass juice concentrate was tested for estrogenic activity by the uterine weight method using one month old castrated female rats. A standard dose-response curve was established with estradiol benzoate to compare with the dose-response of the grass juice concentrate at various levels. The maximum uterine growth response produced by the grass juice concentrate (50 per cent dry matter) indicated that 1 cc. contained approximately the equivalent of 0.016 milligram of estradiol benzoate.

97 pages. \$1.21. MicA 55-6

**INVESTIGATIONS ON AN UNIDENTIFIED
GROWTH FACTOR IN GRASS JUICE
REQUIRED BY CHICKS AND POULTS**

(Publication No. 10,588)

Leo Stanley Jensen, Ph.D.
Cornell University, 1954

Reports from numerous investigators show the existence of several unidentified factors which are required in the food supply of certain animals for the attainment of maximum growth rates. The juice from fresh forage is a potent source of at least one of these factors. The studies reported in this thesis were undertaken (1) to develop experimental diets for chicks and poults suitable for bioassay of the grass juice factor, (2) to determine some of its chemical properties and to concentrate the factor, and (3) to study the relationship of the factor to certain known nutrients and growth stimulants and to other unidentified factors.

In studies on experimental diets, a diet based on fish meal, soybean oil meal, corn, wheat and oats with other necessary supplements was found suitable for use with poults. A semi-purified diet containing crude fish meal as the only protein source was developed for use with chicks. The chick response to grass juice was greater when the diet contained glucose rather than corn starch as the carbohydrate source. The use of a sulfonamide, a high protein level, or fish meal purified by acid-washing did not increase the magnitude of response to the unidentified factor.

By fractionation procedures, it was found that the factor was dialyzed through a cellophane membrane, adsorbed on activated charcoal and removed by washing with dilute ammonium hydroxide, and exchanged on a weak cation exchange resin. The factor was precipitated from water solution in the range of pH 7 to 8. It was insoluble in non-polar solvents such as benzene and diethyl ether but was soluble in more polar solvents such as acid-acetone and 70 per cent ethyl alcohol. Phenol extraction of a water solution of the factor showed that the activity was distributed between the phenol and water phases. Counter-current distribution studies with a phenol-water system revealed the presence of a growth inhibitor in the grass juice. The interference of the growth inhibitor in the counter-current distribution experiments made it impossible to determine whether the growth response to the grass juice was caused by a single factor or a complex of factors.

Marked growth responses were obtained with certain fractions contributing as little as 30 milligrams per 100 grams of diet.

A complete mutual sparing action between grass juice and an antibiotic was observed with turkeys. However, an antibiotic failed to spare the requirement of chicks for the growth factor present in grass juice. These contrasting results may be related to the fact that the turkeys received a diet of crude feed-stuffs whereas the chicks received a semi-purified diet. It was also observed that the requirement of turkeys for methionine and of chicks for arginine

were reduced when the diets contained grass juice.

In studies on the relationship of grass juice to other sources of unidentified factors (fish solubles, distillers' dried solubles and dried whey), it was found that at least three different unidentified growth factors were required by chicks. Grass juice is a potent source of one of these unknown factors, but dried whey was a variable source of the same factor. Dehydrated alfalfa meal was shown to be a poor source of the factor present in grass juice.

122 pages. \$1.53. MicA 55-7

**SELECTION INDICES BASED ON MILK AND
FAT YIELD, FAT PER CENT, AND TYPE
CLASSIFICATION OF DAIRY CATTLE**

(Publication No. 10,553)

Kenneth Ambrose Tabler, Ph.D.
University of Illinois, 1954

The Herd Improvement Registry lactation and type records of 2810 daughters and mates of 756 sires from 414 Jersey herds were analyzed. The lactation records were adjusted to a 305 day, 2X Mature Equivalent basis. From these records the intra-sire estimates of the parameters necessary to construct a selection index were obtained.

The heritability of differences in single records of milk yield, fat yield, fat per cent, and type were estimated by doubling the intra-sire regression of daughter on dam and were 0.25, 0.20, 0.56, and 0.25, respectively. For the daughters' records the intra-sire phenotypic correlations were -0.36 between milk yield and fat per cent, 0.88 between milk yield and fat yield, 0.08 between milk yield and type, 0.15 between fat per cent and fat yield, 0.05 between fat per cent and type, and 0.11 between fat yield and type. The corresponding intra-sire genetic correlations were -0.50, 0.72, 0.07, 0.20, -0.01, and 0.08, respectively.

The relative economic values used for milk and fat yield were one and 17.6. Fat per cent was given a relative economic value of zero in all of the indices. The assumed economic value for type was zero or the pounds of milk, 2139.3, or fat, 109.2, required to equal a change of one grade in type.

Indices for estimating the genic values for milk yield, fat per cent, fat yield, and type by utilizing the information on the phenotypes of these traits were developed. The indices were derived so that the correlation between the aggregate genotype and the index would be a maximum. The expected phenotypic reach and the expected genetic gain for each trait was computed.

The expected genetic gains of the indices indicated that the genic value for milk yield can be estimated ten per cent more accurately when the cow's fat yield is also considered. Fat yield alone is a good indicator of a cow's genic value for fat yield. The net gains of the indices were compared by converting

the expected genetic gains in milk and fat yield to a milk equivalent basis with the result that milk yield alone was a good criterion of selection. Selection for type along with milk yield resulted in a 15 per cent decrease in the expected genetic gain of milk and fat yield on a milk equivalent basis.

64 pages. \$1.00. MicA 55-8

AGRICULTURE, PLANT CULTURE

THE DUTCH ELM DISEASE AS INVESTIGATED BY THE USE OF TISSUE CULTURES, ANTIBIOTICS, AND PECTIC ENZYMES

(Publication No. 10,585)

Francis William Holmes, Ph.D.
Cornell University, 1954

An outline of the nomenclatural state of the perfect stage of *Graphium ulmi* is presented.

Tissue culture methods seem to offer opportunities of studying the effects on elm cells of fungal extracts in the absence of any vascular system to be plugged. A technique is described for obtaining tissue cultures of woody plants at any time of year from their germinated seeds. Callus tissue cultures of *Ulmus americana*, *U. glabra*, *U. pumila arborea*, *Gleditsia triacanthos*, and *Ailanthus altissima* were thus obtained.

Growth, on Gautheret's agar medium plus coconut milk, of tissue cultures from *Ulmus americana* was not affected by the addition to the medium of a filtered extract of *G. ulmi* growth on Zentmyer's medium. The fungal extract caused wilt of elm shoots and presumably contained the toxins ascribed to *G. ulmi* by Zentmyer and by Dimond. The relation of these results to Pope's evidences (Cornell University Ph.D. thesis, 1943) for local action of *G. ulmi* is discussed.

G. ulmi coremiospores, germinating in elm extract, potato dextrose juice, or Zentmyer's medium, produced a pectic enzyme or enzymes which, like those of *Botrytis cinerea*, rotted potato discs and blackened broad bean leaves. The discovery that *G. ulmi* produces such enzymes in culture is not proof that they are the wilt-inducing mechanism. Nevertheless, it is suggested that high molecular weight breakdown products of pectin may by adsorption reduce the area of the pores in vessel endwalls or interfere with the permeability of cell walls or of the outer membrane of the cytoplasm. Moreover, the consequent weakening of the middle lamellae in the pits between xylem vessels and ray parenchyma cells may lead to the formation of tyloses and the deposit of gums in the vessels, or to the release of toxic compounds from the injured cells. These actions could cause the Dutch elm disease syndrome.

Of 19 commercially-available antibiotics, 9 inhibited *G. ulmi* at 1000 ppm in culture:

Aureomycin
Candicidin A
Patulin (=Clavacin)
Pleocidin
Polymyxin
Bristol A6786-23-108
Merck Agricultural Antibiotic 52R4009
Thiolutin
Gramicidin S

Nevertheless, these 19 and 3 others, when injected into young elms from waxed craft paper funnels around their trunks, did not prevent the establishment of the Dutch elm disease by subsequent artificial inoculations. Whether a useful correlation exists between cultural and field tests of antibiotics is discussed.

Isonicotinic acid hydrazide, applied by funnel or spray to compete with the pyridoxine for which *G. ulmi* is deficient, killed the elms at 10,000 ppm, and did not decrease disease at 4 lower concentrations.

Cultures of 198 known and 176 unidentified fungi, bacteria, and actinomycetes, grown adjacent to *G. ulmi* on potato dextrose agar, showed various inhibitory qualities, not limited to any particular taxonomic groups. The most effective of the unknown inhibitors was determined to be *Bacillus polymyxa*, which, however, when inoculated into elms 6 days before they were inoculated with *G. ulmi*, did not prevent disease.

150 pages. \$1.88. MicA 55-9

RING SPOT AND YELLOWS OF CHERRY: ORCHARD SPREAD, INJURIOUS EFFECTS ON THE TREES, SYMPTOM EXPRESSION ON DIFFERENT VARIETIES, AND INFLUENCE OF TREE NUTRITION AND LIGHT ON DISEASE DEVELOPMENT

(Publication No. 10,590)

Edward John Klos, Ph.D.
Cornell University, 1954

Studies in a Montmorency orchard showed the ring spot virus spread rapidly, frequently followed by yellows in the same or later years. Ring spot and yellows showed no definite pattern of spread.

In one case, following the first appearance of ring spot, yield was reduced 2 years, and in another, it was reduced only one year. On yellows trees yield was down in all years succeeding the first symptom year; the trees showed an increase in length of terminals and in fruit size.

There were no differences in trunk circumference or soluble solids content of fruit among any of the ring spot, yellows or healthy tree groups.

Symptomatology following artificial inoculations with several virus sources showed a close relationship between sweet cherry lace leaf and ring spot of sour cherry.

Field plot experiments and leaf anatomy studies

indicated that yellows and ring spot travel in the phloem or phloem-related tissues.

Bud inoculations in twigs done in the fall (mid-September) gave better results than spring graft inoculations, with the exception of those made in the trunk.

Symptom expression was enhanced by moderate or heavy pruning at the time of inoculation. Trees inoculated with recurrent ring spot early in the growing season and cut back gave the best symptoms in both the first and second years. Yellows showed up in the first year on trees inoculated and cut back before bloom.

Ring spot symptoms consisted of necrotic areas on leaves of trees kept under 700 foot candles from 8 A.M. to 10 P.M..

Only leaves showing yellows symptoms showed a decrease of total chlorophyll content.

The leaf spot fungus *Coccomyces hiemalis*, in most cases, infected leaves of trees which contained ring spot or yellows more severely than those on healthy trees.

In the first nutrient experiment, Mazzard seedlings showed chlorotic rings and shredding when inoculated with ring spot. Etch was found only in complete, high phosphorous, high potassium and low nitrogen treatments. High and low phosphorous treatments had the greatest reduction in growth, while the low potassium showed the least reduction in growth by inoculation.

In the second nutrient experiment, Montmorency trees were subjected to nutrient solutions containing high nitrogen, minus nitrogen, high potassium, minus potassium, high phosphorous, minus phosphorous and complete. Trees inoculated with yellows did not show etch, which was found on the ring spot trees. The yellows trees exhibited strong rosette and a high mortality rate. On yellows-inoculated trees, the high potassium and high phosphorous treatments showed an increase in growth, chiefly lateral, over other nutrient treatments.

Minus nitrogen, complete nutrient, high potassium and minus potassium treatments gave the best ring spot symptoms.

Determinations were made of the nitrogen and phosphorous content of the leaves from uninoculated, ring spot inoculated, ring spot propagated and yellows inoculated trees. It was difficult to correlate disease effects and nutrient treatments.

123 pages. \$1.54. MicA 55-10

INOCULATION STUDIES AS RELATED TO BREEDING FOR RESISTANCE TO BACTERIAL WILT IN LESPEDEZA

(Publication No. 10,125)

Marion Samuel Offutt, Ph.D.
University of Missouri, 1954

Bacterial wilt, caused by *Xanthomonas lespedezae* (Ayers et al.) Starr, is the most destructive disease

of the annual lespedezas in Missouri. It is more damaging in Korean lespedeza (*Lespedeza stipulacea* Maxim) than in common lespedeza (*Lespedeza striata* Thunb.).

Studies were made of the host-parasite relationship and of inoculation and evaluation techniques as they relate to breeding for wilt resistance in annual lespedeza.

Results indicated that the wilt bacterium entered and infected annual lespedeza through wounds. Once the wilt pathogen had gained entry into the host, it tended to spread within the xylem vessels at a more rapid rate and to advance further in susceptible strains than in resistant strains.

The percentage of plants of susceptible strains which become infected with wilt from natural causes is small, probably less than 3 per cent. Of thirty-four diseased seedlings sectioned and examined under a microscope, all were found to be the most heavily infected in or near the cotyledons.

Hulls from stored seed, and stems and debris from diseased plants left in the field during the winter were shown to harbor virulent bacteria as late as April of the following year.

When natural epiphytotics occurred, secondary spread appeared to be involved. Three possibilities of secondary spread were indicated, all of which involved wounding of the host. The possibilities indicated were: (1) the grazing and trampling of animals, (2) the feeding of grasshoppers and other insects, and (3) mowing, especially when the forage was wet.

A measure of the wilt resistance of lespedeza strains was obtained by determining the yield reduction due to wilt on a percentage basis. Yield reduction following field inoculation ranged from about 5 per cent for the more resistant strains to around 50 per cent for the more susceptible strains. Forage quality was lower in susceptible strains than in resistant strains due to more severe stunting and to a higher percentage of dropped leaves.

The variation of any one of several factors was shown to exert an influence on the severity of infection. High concentrations of bacteria in the inoculum produced more severe infection than did low concentrations. Younger plants were more severely damaged by wilt than were more mature plants. All of the lespedeza strains tested were more susceptible to the wilt bacterium under winter light conditions than under spring or summer light conditions. The degree of infection was greater following foliage inoculation than following root inoculation. Inoculating plants at a single point (leaf, stem, or cotyledon) was not as severe as inoculating plants at two or more points.

Procedures were suggested for (1) obtaining an index to be used as a guide for estimating the yield reduction due to wilt in commercial fields, (2) measuring the wilt resistance of lespedeza strains in the greenhouse in winter, and in the field in summer, (3) selecting the most resistant individuals in large populations, and (4) combining a study of the inheritance of wilt resistance and maturity with a breeding program for developing wilt resistant strains.

125 pages. \$1.56. MicA 55-11

VARIATION IN CYANOPHORIC PROPERTIES OF WHITE CLOVER (*TRIFOLIUM REPENS* L.)

(Publication No. 10,532)

Herbert Lester Portz, Ph.D.
University of Illinois, 1954

Cyanophoric properties of white clovers were studied to determine whether or not the existing certification procedure for Ladino clover is adequate to maintain genetic purity and identity of this variety. In addition the investigation was designed: (1) to study the variability of cyanophoric properties in Ladino and other white clovers, (2) to determine the factors causing this variability, and (3) to determine if cyanophoric and/or other properties can be utilized in the certification of Ladino clover and other improved white clover varieties.

Many white clover plants possess cyanophoric properties, a cyanoglucoside, lotaustralin, and its hydrolyzing enzyme, linamarin. These properties are genetically controlled and can be identified by a simple qualitative method, the modified Guignard picrate-paper test.

Differences in cyanophoric properties of white clover from various sources were found.

1. In 79 seed lots of Ladino and other white clovers, the frequency of cyanogenetic plants varied from 0 to 100 percent.
2. In 147 seed lots of certified Ladino clover, the amount of seedlings having both glucoside and enzyme was 2 percent of the 1168 seedlings from Washington, 4 percent of the 1622 from Oregon, 9 percent of the 699 from Idaho, and 15 percent of the 925 from California.
3. Most Ladino clover seed lots from Italian sources were found to contain a very low frequency of plants with cyanophoric properties.
4. Head samples of wild-growing white clover collected from scattered areas in the United States produced from 17 to 90 percent glucoside plants. In these collections, 59.5 percent of the variation in plants with glucoside and 42.8 percent of the variation in plants with enzyme were accounted for by the association with January mean temperature.

Three reasons postulated to explain the differences in observed gene frequency were: (1) variation in original seed lots, (2) shifts due to natural and artificial selection, and (3) outcrossing with other white clovers.

In a greenhouse experiment, Ladino clover plants with cyanophoric properties flowered earlier and more profusely than did those without these properties. In the field, 47 percent of the early blossoming Ladino clover plants contained cyanophoric properties whereas 33 percent of the non-blossoming plants contained them.

Different levels of nitrogen and phosphorous mixed with soil and temperatures of 55°F. and 75°F. did not affect the qualitative tests for cyanophoric properties. Likewise, quantitative tests showed no

significant differences in potential HCN content of white clover when two rates of nitrogen and phosphorous were used in sand culture.

Kura clover, *Trifolium ambiguum*, was shown to contain large amounts of a cyanoglucoside, but no enzyme.

Results of inheritance studies which were in agreement with previous investigations by other workers showed that two unlinked complimentary genes account for the presence or absence of the cyanophoric properties.

On the basis of this study, it appears that genetic shifts in Ladino clover, as measured by variations in cyanophoric properties, have taken place and it is suggested that the present certification procedure for this variety is inadequate to maintain genetic purity. The establishment of breeder seed and a limited generation system is suggested for certification of Ladino clover or other improved white clover varieties. In the selection of breeder seed, it would be desirable to obtain plants having neither glucoside nor enzyme so that contamination from other white clovers might be easily detected. This qualitative test would supplement the present certification standards and would not replace them.

113 pages. \$1.41. MicA 55-12

AN EVALUATION OF HERBICIDAL MATERIALS AND THEIR EFFECTS ON THE YIELD AND BOTANICAL COMPOSITION OF FORAGE LEGUMES WITH SPECIAL REFERENCE TO THE CONTROL OF YELLOW ROCKET, (*BARBAREA VULGARIS*)

(Publication No. 10,604)

Marvin Mandel Schrieber, Ph.D.
Cornell University, 1954

Within recent years, yellow rocket (*Barbarea vulgaris*) has become the worst weed in forage legumes in the state of New York and many areas of the northeast. Early attempts for its control have often resulted in injury and subsequent reduction of forage yields due to the high degree of susceptibility of the various legume species present.

In an effort to clarify some of the variability in the results reported in the literature on forage legume work and to establish a basis for sound recommendations, a series of experiments were initiated at several locations in the state of New York to study the affects of chemicals, chemical concentration and stage of growth at time of application on four legume species: alfalfa, birdsfoot trefoil, medium red clover and ladino clover. Four commonly available and frequently recommended herbicides were included: 2, 4-D, (2,4-dichlorophenoxyacetic acid), MCP, (2-methyl-4-chlorophenoxyacetic acid), DNOSBP, (2,4-dinitro-6-sec-butylphenol) and CIPC, (Isopropyl-N-(3-chlorophenyl) carbamate) as well as two new ones: 3,4-D, (3,4-dichlorophenoxyacetic acid) and 4 Chloro, (4-chlorophenoxyacetic acid).

It was found that MCP at concentrations of 1/8 to 1/4 pound per acre was as injurious to alfalfa as 2,4-D at the same stage of growth. Birdsfoot trefoil was injured more by MCP than 2,4-D while the reverse relationship existed for medium red clover. Ladino clover was generally unaffected by any of the chemicals at all stages of growth. DNOSBP and CIPC were found to have no deleterious effects at any of the growth stages and on any of the legume species tested.

No significant differences were observed between the various MCP formulations when considered over all stages and crops. Thus, it appears that the MCP 90 percent materials have no advantage over the MCP 60 percent materials regardless of formulation.

The data showed less yield reduction at the 5 to 7 inch stage of growth on alfalfa and birdsfoot trefoil than at any other time when the vegetative portions of the plants were exposed.

Recovery from initial injury appears to be an important factor in the final evaluation of herbicidal effect. It was found that recovery was a function of stage of growth at the time of application and concentration of the translocated herbicides used. The greater the leaf area exposed at time of spraying at concentrations less than 1/4 pound per acre, the greater the recovery that can be expected in subsequent cuttings.

Spraying translocated herbicides within a week after first or second cutting has been shown to be non-injurious to alfalfa. This suggests a possible stage of growth at which alfalfa could be sprayed for yellow rocket control. If a forage crop is infested with yellow rocket, cutting early for hay crop silage would prevent seed formation and possible seed dissemination in hay and manure. The yellow rocket plants would not be present in the second cutting for hay since only new rosette leaves form after seed stalks are cut. Thus spraying after second cutting would eradicate the yellow rocket plants present from the seeding with subsequent yellow rocket free hay for the entire duration of the stand. Some seeds in the soil will germinate but generally the percentage is negligible.

Fall application of 2,4-D or MCP consistently decreased the percentage of alfalfa in the forage legume mixtures. As the concentration of translocated herbicides increased the percentage of alfalfa decreased. At lower concentrations (1/8 to 1/4 pound per acre) there again was no difference in response due to 2,4-D or MCP.

Two new herbicides, 4 Chloro and 3,4-D, were field tested. 4 Chloro was found to be extremely injurious to alfalfa and medium red clover when applied during the winter and spring stages of growth. 3,4-D however, was shown to be less injurious to all legumes than 2,4-D, MCP or 4 Chloro at the same concentration. Its selectivity, however, was less than 2,4-D, MCP, and 4 Chloro with reference to the control of yellow rocket. The results of the first field tests with 3,4-D would certainly warrant further experimentation. Seasonal variation may cause serious injury with 2,4-D and 4 Chloro on medium red clover as has been reported in this study.

If adequate control of yellow rocket is to be obtained from the use of translocated herbicides in forage legumes, particularly alfalfa, birdsfoot trefoil and medium red clover, some degree of injury should be expected regardless of stage of growth.

230 pages. \$2.88. MicA 55-13

ANALYSIS AND INTERPRETATION OF A LONG-TIME SOIL FERTILITY EXPERIMENT IN SOUTHERN ILLINOIS

(Publication No. 10,547)

Milton Davis Shulman, Ph.D.
University of Illinois, 1954

Twelve years' data from a four-year rotation soil fertility experiment are analyzed in such a manner as to avoid some of the complications in analyzing an experiment of this kind which arise out of its long-term nature. The report of this analysis is considered somewhat preliminary because of the relatively short period of time considered.

This is a 3³ x 2 factorial experiment which considers various levels of N, K, and L and two carriers of P, separately and in association. Various methods which have been proposed for analysis of data of this kind are discussed and rejected. The scheme of multivariate analysis is discussed and presented as a comprehensive method of analysis which will extract all the available information from the data, and therefore as a desirable method of analysis for the results of this experiment.

Results of the analysis are presented in a series of graphs and tables which illustrate the treatment effects and the differential crop responses. Treatment effects show significant associative effects of the nutrient elements, as well as main effects of the elements considered individually. The nature of these associative effects and their causes is not clear in many cases, indicating the need for further work in the laboratory and in the field.

All of the nutrient elements considered increased the yield of crops on plots to which they were added over plots to which they were not added. This is reasonable in view of the extremely poor condition of the soil in an average untreated condition. The greatest yield responses were to the addition of limestone, and soil acidity is therefore considered the most limiting non-physical factor of crop growth. Other elements were also effective in increasing yield, but not to the same extent as limestone.

Third cycle yields were analyzed in greater detail since they furnish the best estimate of the equilibrium to which yield differences will approach with time. Wheat is the crop most responsive to treatment and is the only crop for which there is a significant difference between phosphate carriers. Some question exists as to whether this is actually due to the greater response of wheat to superphosphate, or to the fact that the superphosphate is applied with the wheat. Further data are necessary to answer this question. The L x K interaction is the only

consistently significant one over all crops; this indicates the desirability of ascertaining the relationship of these two elements. As a matter of fact, the entire subject of the effects and functions of K seems to be one which requires additional research.

It is noted that in an experiment of this kind three-factor interactions may be significant but that because of the nature of the confounding in this experiment they could not easily be separated out. This raises a question as to whether this experiment (and possibly others similar to it) should not have been designed to give information on two- and three-factor interactions by designing it in parts, in each of which some desired interactions are unconfounded. Further study of this question may prove valuable.

With the continuance of this experiment, further data will be accumulated which should be analyzed periodically. As these data become sufficient to estimate asymptotes the value of the experiment will become even greater. The method of multivariate analysis might then prove to be an even more valuable tool of analysis.

87 pages. \$1.09. MicA 55-14

REPRODUCTIVE PERFORMANCE OF THE SOW: NORMAL FETAL DEVELOPMENT AND THE NEED FOR CERTAIN VITAMINS

(Publication No. 10,559)

Duane Earl Ullrey, Ph.D.
University of Illinois, 1954

The investigations of the reproductive performance of the sow were presented in three sections.

Part I was concerned with normal development of the swine fetus during the latter half of gestation. One hundred sixty-three fetuses of known age from both sows and gilts were studied. The following measurements were made: total fetus weight, width of the skull, length of the fetus, length of the right humerus, length of the calcified area of the humerus, radius, ulna, femur, and tibia, and weight of the brain, heart, lungs, liver, and kidneys. Estimating equations were developed by the method of least squares, relating the measurements to age. It was found that skeletal measurements were generally most reliable in estimating age of fetuses of unknown conception date. Total length, length of the humerus, or length of the calcified area of the long bones may satisfactorily be used.

Part II was concerned with the pathological manifestations of thiamine, riboflavin, and pantothenic acid deficiencies in pregnant swine. Twelve Chester White gilts were divided among four treatments, three lots receiving diets deficient in thiamine, riboflavin, or pantothenic acid and the fourth lot receiving an adequate diet. Reproductive performance of the positive controls was unsatisfactory. Only three live pigs were born. None of the other gilts farrowed live pigs, although conception occurred in all treatments except the pantothenate deficient group.

Thiamine deficiency was accompanied by anorexia, emesis, polypnea, centro-lobular congestion and hemorrhage in the liver, diffuse nephrosis, ventricular dilatation, and focal necrosis of the cardiac muscle.

Riboflavin deficiency was accompanied by severe anorexia, swelling of the metatarsal and metacarpal regions, accumulation of a dark, red exudate about the head, and diffuse nephritis with some fatty infiltration.

Pantothenic acid deficiency was accompanied by diarrhea, discharge of blood from the anus, moderate anorexia, locomotor incoordination and "goose stepping," ovarian atrophy and uterine regression.

Part III was concerned with levels of pantothenic acid and reproductive performance of female swine. After four weeks of pantothenate depletion, thirty-two, sexually-mature gilts were divided among two replicates with four treatments per replicate.

The total pantothenic acid intake in each treatment was 1.0, 5.4, 12.0, or 18.6 mg. of pantothenic acid per kilogram of diet.

A dietary intake of 1.0 mg. or 5.4 mg. was not sufficient to prevent development of pantothenate deficiency symptoms. The deficiency affected the Durocs in replicate 1 more severely than the Hampshires and Hampshire x Yorkshire crossbreds in replicate 2.

Gilts fed the 5.4 mg. level conceived, and gestation was supported to term. However, abnormal pigs were farrowed.

Total gestation-lactation performance, as measured by the average litter weaning weight of litters farrowed, was equal in lots receiving 12.0 and 18.6 mg. of pantothenic acid per kilogram of diet and was superior to that of lots receiving 5.4 mg. or less.

The free pantothenic acid content of milk collected during the fourth and fifth week of lactation was significantly less when the gilts received only 5.4 mg. of pantothenic acid as compared to higher levels of intake.

Under the conditions of this investigation, it appears that 12.0 mg. of pantothenic acid per kilogram of diet are adequate to support normal reproduction of female swine.

124 pages. \$1.55. MicA 55-15

AMMONIUM AND NITRATE NITROGEN ABSORPTION BY YOUNG APPLE TREES IN SOIL OR ARTIFICIAL NUTRIENT MEDIA OF VARYING ACIDITY

(Publication No. 10,615)

David Zimmerman, Ph.D.
Cornell University, 1954

The practice of spraying with elemental sulfur for scab control in Northeastern apple orchards has resulted in a large increase in soil acidity. The present investigation was undertaken to indicate the

effect of soil acidification on the nitrogen nutrition of the trees.

The field work indicated that in the unlimed surface six inches of a Dunkirk silty clay loam orchard soil that had increased in acidity to pH 3.5, the rate of nitrification of soil ammonium nitrogen or of applied ammonium fertilizers was materially retarded. Ammonium nitrogen was consequently the predominant form in which inorganic nitrogen was available to the trees. The relative rates of absorption of ammonium nitrogen and nitrate nitrogen were subsequently studied with seedlings and young apple trees in greenhouse experiments involving soil, sand, and solution media.

The soil studies indicated a very marked response to the application of lime and to fertilization with potassium, magnesium, and phosphorus. The growth of the seedlings in the unlimed soil at pH 3.5 or in the soil the pH of which was increased from pH 3.8 to 5.7 by liming was not limited by the available supply of ammonium or nitrate nitrogen. In all treatments receiving lime the application of ammonium sulfate resulted in a larger increase in the nitrogen content of the seedlings than the application of an equivalent amount of nitrogen as calcium nitrate. The application of ammonium sulfate to the unlimed soil at pH 3.5, however, had aggravated the unfavorable conditions for the growth of the seedlings and was associated with a large mortality of seedlings. It was also noted in the soil studies that the decrease in the content of ammonium and nitrate nitrogen in the soil

medium was not accompanied by a quantitative increase in plant nitrogen. The discrepancies in nitrogen balance were explicable by such microbially mediated nitrogen transformations as the ammonification of the soil organic matter, the nitrification of ammonium nitrogen, and the immobilization of applied ammonium or nitrate nitrogen.

A sand-culture study by the subirrigation method also indicated that at pH 4.0 and 6.0 ammonium nitrogen was more rapidly absorbed by young apple seedlings than was nitrate nitrogen. Similar results but of smaller magnitude were also observed in a short-interval study with young apple trees that received the differential nitrogen treatments by surface application of the nutrient-solutions to the sand.

The absorption of ammonium and nitrate nitrogen by young apple trees was also studied by the water-culture method. Nitrogen absorption was measured by the relative decrease in the concentrations of ammonium and nitrate nitrogen from buffered nutrient solutions containing ammonium nitrate. The study afforded a comparison, therefore, of the rates of absorption of ammonium and nitrate nitrogen by each individual tree in the experiment. Ammonium nitrogen was found to be more rapidly absorbed at pH 4.0, 5.0, and 6.0 than nitrate nitrogen. Relatively larger rates of absorption of ammonium nitrogen compared with nitrate nitrogen were observed for the more vigorously growing trees.

193 pages. \$2.41. MicA 55-16

ANATOMY

TAXONOMIC STUDIES OF SARCOPHAGA LARVAE OF NEW YORK WITH NOTES ON THE ADULTS

(Publication No. 10,603)

John Sanjean, Ph.D.
Cornell University, 1954

Of the thirty-two species of Sarcophagidae collected in the Ithaca, N. Y. area, the following sixteen species were reared: *Sarcophaga bullata* Pk., *S. melanura* Mg., *S. scoparia nearctica* Pk., *S. argyrostoma* R. D., *S. crassipalpis* Mgt., *S. haemorrhoidalis* Fall., *S. cimbicis* Tns., *S. latisterna* Pk., *S. bisetosa* Pk., *S. rapax* Wlk., *S. latisetosa* Pk., *S. pusiola* v. d. W., *S. l'herminieri* R. D., *S. ventricosa* v. d. W., *S. cingarus* Ald. and *S. fletcheri* Ald.

Improved techniques are described for the collection and rearing of sarcophagids, and preparation of

specimens for the taxonomic study. With these techniques it was found possible to identify the various stages of the larvae studied. The names of a number of the structures used by various authors are summarized and some new terms are proposed to help establish a more stabilized nomenclature for the descriptions of dipterous larvae.

Biological notes for all stages include data on life cycle duration, copulation, larviposition, brood size and mating behavior.

Ecological records show that the greatest number of flies were collected at air temperatures of 76° to 88° F., humidities of 54 to 56% and with a falling barometer. No conclusions were drawn from data on cloudiness and wind velocity. The number of individuals of each species showed a decided preference for some baits and resting places.

158 pages. \$1.98. MicA 55-17

BIOLOGY — GENETICS

AN ANALYSIS OF ULTRAVIOLET AND X-RAY RADIATION ON CHROMOSOMES OF ZEAMAYS

(Publication No. 10,106)

Margaret Helen Emmerling, Ph.D.
University of Missouri, 1954

Supervisor: L. J. Stadler

A cytological analysis was made of the effects of ultraviolet and x-ray radiation on the production of deficiency-aberrations in chromosomes nine and ten of maize. A homozygous recessive stock was pollinated by treated pollen from a homozygous dominant stock. The F_1 plants which exhibited deficiencies for the specific gene markers on chromosomes nine and ten were saved for cytological analysis. Spontaneous aberrations were found in chromosome ten by means of selecting colorless seeds and plants from the cross of $r^8/r^8 \times R^r/R^r$.

In the chromosome nine series, the gene bronze provided the genetic marker for selecting the cytological deficiencies and various terminal knobs on the end of the short arm of chromosome nine acted as the cytological markers for distinguishing true terminal deficiencies. Mature pollen from plants homozygous for $Bz\ K/Bz\ K$ was irradiated and pollinated on homozygous recessive plants (bz/bz). In the chromosome ten series the gene R^r provided the genetic marker and the aberrant knob ten furnished the cytological marker. Pollen of the $R^r\ K/R^r\ K$ stock was irradiated and placed on silks of homozygous recessive plants, r^8/r^8 . Cytological aberrations which occurred spontaneously were studied in two R^r/R^r stocks, one heterozygous for knob 10 (K/k), and the other lacking the knob 10 (k/k).

Analysis of the cytological results showed that (1) a larger number of aberrations occurred in plants following treatment with a low dose of x-rays (400r) than in plants treated with two heavy doses of ultraviolet (UV 20 and 30 seconds); (2) a lower rate of complex deficiencies occurred in chromosome nine following treatment with ultraviolet radiation (UV 10, 20 and 30 seconds) than in chromosome nine following x-ray treatments (400r, 800r, 1200r); (3) probably a lower frequency of terminal deficiencies occurred in chromosome nine following treatment with x-ray radiation than following treatment with ultraviolet radiation. The higher frequency of chromosomal aberration in x-ray series than in ultraviolet series is probably a dosage and intensity effect. The higher frequency of terminal deficiencies in the ultraviolet series could be attributed to (1) high frequency of restitution of broken chromosomal ends

in the ultraviolet series, or (2) low rate of coincident breaks in ultraviolet series, or (3) same frequency of breaks in each cell in the ultraviolet and x-ray series but failure of fusion or broken chromosomal ends in the ultraviolet series.

Two types of deficiency translocations, 3-chromosome and 3 1/2-chromosome, were described and illustrated. These two types of translocations were discussed with regard to the nature of broken chromosomal ends induced by ultraviolet and x-ray radiation. Among 19 deficiency translocations in the x-ray treated series, all were of the 3-chromosome type. In the ultraviolet treated series one 3 1/2 chromosome and two 3-chromosome deficiency translocations occurred.

The type and frequency of spontaneous aberrations did not differ between the heterozygous knob ten stock and the homozygous knobless ten stock. It was concluded, therefore, that knob ten had no effect on the production of spontaneous aberrations.

102 pages. \$1.28. MicA 55-18

THE BIOLOGY OF THE CLOVER HEAD WEEVIL, TYCHIUS STEPHENSI SCHOENHERR, WITH SOME NOTES ON CONTROL

(Publication No. 10,600)

Arthur Allen Muka, Ph.D.
Cornell University, 1954

The clover seed insect, Tychius stephensi Schonh., is a European species which appears to be mainly a pest of red clover. Its presence in North America has been known since 1908 when specimens taken in New York State were described by Schaeffer as a new species. In the past the species has often been confused with the European clover seed weevil, Miccotrogus picrostris Fab., and various authors have reported it erroneously under that name.

The distribution of Tychius stephensi is widespread in the northern section of the United States and in Eastern Canada. It has been reported from Connecticut, Delaware, Illinois, Indiana, Maine, Massachusetts, Michigan, Minnesota, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Vermont, Virginia, Washington and West Virginia in the United States and from the Canadian Provinces of New Brunswick, Nova Scotia, Quebec and Ontario.

In the areas where red clover seed is produced in the United States and Canada the insect has been reported as an important pest. A study made in New York indicated that losses of 45 to 65 percent in

yields of seed can occur where the insect has built up heavy populations.

The larvae feed and grow on the developing red clover seed, and the adults feed on the reproductive portions of the flower. The adult overwinters in sod of red clover both in established fields and in volunteer roadside patches.

In the spring, the beetles emerge during May and commence extensive migration flight activity as the air and soil temperatures increase in late May.

Beetles start oviposition in the florets of red clover as early as heads of clover appear, laying one egg per floret. The egg is placed inside of the corolla

tube on the ovary. The egg, larval, prepupal and pupal stages require an average of 7.7, 11.5, 8.9 and 10.3 days respectively.

There are two generations per year in New York.

No parasites have been found in the field and none are reported in the literature on this insect.

Insecticides applied to red clover in the bud stage within five days of bloom have given up to 79 percent increase in seed yields. However, it was not possible to get increases of this magnitude under similar circumstances each time.

82 pages. \$1.03. MicA 55-19

BOTANY

EFFECT OF VARIOUS FREEZING TEMPERATURES ON THE BEHAVIOUR OF THE STRAWBERRY PLANT

(Publication No. 10,574)

John Fanton Brown, Ph.D.
Cornell University, 1954

Fully hardened, dormant strawberry plants of the Premier (Howard 17) variety were frozen slowly to various minimum temperatures in cabinets in which provision had been made to control the rate of temperature fall. The effect of freezing to various minimum temperatures on subsequent growth, radioactive phosphorus accumulation, respiration, root-rot infection and root injury was measured.

Growth response was determined by obtaining the difference in fresh weight immediately following freezing and after a period of growth in nutrient solution. The accumulation of radioactive phosphorus was recorded by either placing plants after freezing in a nutrient solution containing the isotope or by pipetting a minute quantity of the isotope into the crown-bud. Respiration was measured either by the conventional method of drawing a stream of carbon-dioxide-free air over the plants and absorbing the evolved carbon dioxide in alkali or by using a modification of Denny's method in which both carbon dioxide evolution and oxygen uptake were determined. The effect of freezing on the incidence of root-rot was studied by freezing hardened and unhardened plants growing in both sterilized and unsterilized soil and noting the subsequent amount of lesioning. The loss of solutes from roots, as measured by conductivity techniques, was used to obtain an index of amount of root injury resulting from various freezing treatments.

The results of these studies indicate that fully hardened dormant strawberry plants of the Premier variety show no apparent injury by freezing until the exposure temperature falls to 21° F. At temperatures below this the injury is, in general, proportionate

to the severity of the freezing as indicated by reduced subsequent growth, increased respiration and increased loss of solutes from the cells. Death occurs when the exposure temperature reaches 14 to 15° F. At this temperature the respiration is no longer stimulated but is actually depressed. This depression is proportionate to the exposure temperature from 15° F down to 4 to 0° F at which place no further depression occurs with lowered temperature. There does not appear to be any change in the amount of solutes lost to the bathing solution at the lethal temperature since the effect of temperature shows a straight line relationship all the way from 21° F to 0° F.

Freezing in some way, possibly by interfering with translocation, reduces the ability of the plant to accumulate radioactive phosphorus, and presumably other nutrients, from a solution bathing the roots and from a solution pipetted into the crown-bud. This could partially account for the reduced growth following freezing to moderate temperatures.

Invasion of the roots by soil organisms causing lesions of varying size and some necrosis is apparently facilitated as a result of freezing injury. This appears to be the case even for temperatures above those causing incipient freezing injury. This observation is in line with field observations which have implicated freezing injury in severe root rot outbreaks.

75 pages. \$1.00. MicA 55-20

TRANSLOCATION OF THE FLOWERING EFFECT IN PHOTOPERIODICALLY INDUCED PLANTS

(Publication No. 10,455)

William Alexander Brun, Ph.D.
University of Illinois, 1954

The hormonal theory of photoperiodically induced flower formation was proposed by Cajlachjan in 1936.

Subsequent investigations by numerous workers have given further evidence that a flower-inducing hormone is indeed formed in the mature leaves of photoperiodically sensitive plants when these are exposed to favorable photoperiods, and that this hormone then migrates to the meristematic regions where it causes the initiation of flower primordia. Most of the evidence in favor of the existence of such a hormone is based upon studies of its transmissibility within the plant. Direct evidence in the form of an isolation and identification of the hormone has not been presented.

The present study deals with the transmission of the flower-inducing agent in two short day plants, namely *Xanthium commune* Britt. and *Glycine max* Merr., var. Biloxi. In the course of the experiments it was found convenient, in order to determine the presence or absence of flower primordia, to examine the buds microscopically and to record their appearance photographically. Consequently, a fairly complete photographic record of the development of flower primordia in the two plants experimented with was obtained.

The transmission of the flower-inducing agent has been studied with reference to the tissues in which it occurs. It was found that the transmission occurs in the tissues external to the cambium – probably in the phloem – and that this transmission will not occur through dead tissues. The flower-inducing agent can under certain circumstances be transmitted through root tissue of *Xanthium*.

The transmission of the flower-inducing agent has further been studied with reference to its oxygen requirements. This was accomplished by enclosing a segment of stem in an air-tight chamber through which was passed a stream of pure nitrogen gas. It was found that the rate of transmission through such a stem segment was not affected by a lack of oxygen in its surrounding atmosphere. The treatment did cause a considerable inhibition of the translocation of elaborated food materials and possibly also of the amount of flower-inducing agent transmitted.

The temperature requirements of the transmission of the flower-inducing agent were studied by enclosing stem segments in jackets through which water at certain controlled temperatures was passed. It was found that when stem segments were cooled to between 3° and 5° C., there was no inhibition of the rate of transmission of the flower-inducing agent, although there was a considerable inhibition of the amounts of elaborated foods which were translocated through this stem segment and possibly also of the amount of flower-inducing agent transmitted.

It was further established that the flower-inducing agent can be transmitted from one side of a cocklebur stem to the other. This lateral transmission may occur in a 5 cm. long stem segment with no delay in the time at which the flower-inducing agent reaches its destination.

It was found to take about 6 to 8 hours after the end of a single dark period before enough of the flower-inducing agent is transmitted out of the leaves of cocklebur plants to cause the initiation of flower primordia.

The average rate of transmission of the flower-inducing agent in cocklebur petioles is estimated as 8 cm. in 24 hours.

No decisive evidence was found to substantiate the reports by D. J. Carr that photoperiodic induction is dependent upon the leaves being in organic contact with the buds during the induction period.

104 pages. \$1.30. MicA 55-21

ANTHOCYANIN SYNTHESIS IN MAIZE: GENETIC AND BIOCHEMICAL EFFECTS OF THE FACTORS A_1 , A_2 , AND Bz

(Publication No. 10,460)

Edward Harold Coe, Jr., Ph.D.
University of Illinois, 1954

Phenotypic and chemical studies of materials accumulated in aleurone and plant tissues of the various genetic combinations of the anthocyanin-affecting factors a_1 , a_2 , and bz in maize establish that $a_1 a_1$ individuals in all combinations have the same phenotype, whether this is judged by the color of pigments accumulated in the tissues, or by spectrophotometry, paper chromatography, and phase separation tests on tissue extracts. The double recessive combination $A_1 A_2 a_2 a_2 bz bz$, however, has a phenotype which by some criteria is like that of $A_1 A_1 a_2 a_2 Bz Bz$, by other criteria is like that of $A_1 A_1 A_2 A_2 bz bz$, and by still other criteria is unlike that of either of the singly recessive genotypes. A consideration of the available data has led to the conclusion that A_1 is the first gene to act in a linear sequence of reactions leading to anthocyanin production, and that the sequence $A_1 - Bz - A_2$ is the most likely, although the sequence $A_1 - A_2 - Bz$ is by no means eliminated. Both sequences require that the last-acting factor have broad specificity, with the ability to act upon either of two substrates, and that the substrate of Bz action have certain special properties.

Certain observations show that heterozygous $A_1 a_1$ individuals in acyanic combinations have a chemical phenotype intermediate between $A_1 A_1$ and $a_1 a_1$, especially in terms of the quantity of isoquercitrin-like materials in husk tissue. The occurrence of a small amount of isoquercitrin in husks of $A_1 A_1 a_2 a_2 Bz Bz$ plants, and the absence of detectable quantities of this pigment in husks of $A_1 A_1 A_2 A_2 bz bz$ plants, are reported for the first time. Isoquercitrin is apparently not produced in the normal synthetic pathway leading to anthocyanin, but originates from a precursor which it has in common with anthocyanin.

The presence of an unstable anthocyanin precursor, probably as an aglycone, in aleurone tissue of $A_1 A_1 a_2 a_2 Bz Bz$ kernels is reported. This precursor can be converted to anthocyanin *in vitro* by heating a weakly acidic extract of the aleurone tissue. All the known genetically acyanic kernel types accumulate substances which can be converted to anthocyanin with hot concentrated HCl. It is likely

that glycosidation is very close to the final step in anthocyanin production.

59 pages. \$1.00. MicA 55-22

COMPARATIVE PHYSIOLOGY OF SOME MEMBERS OF THE GYMNOASCACEAE

(Publication No. 10,480)

Gouri Rani Ghosh, Ph.D.
University of Illinois, 1954

This investigation was performed in order to determine the utilization of carbon sources and nitrogen sources, and the vitamin requirements and trace element requirements of selected species of Gymnoascaceae. The species examined were Arachnietus reticulatus, Myxotrichum uncinatum, Gymnoascus reessii, Ctenomyces serratus, and Eidamella deflexa. Penicillium spiculisporem, a member of the related Aspergillaceae, was included in the study for comparative purposes.

The carbon sources examined were: dextrose, fructose, galactose, maltose, sucrose, lactose, raffinose, xylose, dextrin and sodium lactate.

The nitrogen sources employed were: sodium nitrate, ammonium nitrate, ammonium sulphate, asparagin, glycine, casein hydrolysate and a mixture of amino acids.

The vitamins examined were: thiamine, biotin, inositol, pyridoxin and calcium pantothenate.

The trace elements tested were: iron, zinc, copper, and manganese.

Myxotrichum uncinatum utilized dextrose, fructose, galactose, maltose, sucrose, raffinose, dextrin and sodium lactate. Of these compounds, raffinose, dextrin and sucrose permitted excellent growth. Eidamella deflexa utilized all of the carbon sources except sodium lactate. Gymnoascus reessii, either did not grow at all or else grew only poorly on the carbon sources which were tested. Fructose was the only compound which was utilized by Ctenomyces serratus. Arachnietus reticulatus utilized maltose, fructose and dextrose, in that order. Penicillium spiculisporem utilized all the carbon sources tested, with the exception of lactose and sodium lactate.

Of the inorganic nitrogen sources which were tested, sodium nitrate was utilized only by M. uncinatum and E. deflexa. All grew on the organic nitrogen compounds which were employed. A mixture of amino acids was the best source of nitrogen for M. uncinatum, G. reessii, C. serratus and A. reticulatus. Asparagin was the best nitrogen source for E. deflexa. Sodium nitrate, ammonium nitrate, ammonium sulphate, asparagin, glycine, casein hydrolysate and the mixture of amino acids were utilized by P. spiculisporem. Asparagin supported the maximum yield.

Myxotrichum uncinatum and M. deflexa appear to be self sufficient for the vitamins which were tested. A partial deficiency for vitamins was shown by G. reessii, for biotin and pyridoxin, by C. serratus, for

thiamine, and by A. reticulatus, for thiamine and pyridoxin. Penicillium spiculisporem showed a partial deficiency for pyridoxin and pantothenate.

In the studies on trace element requirements zinc and copper were found to be essential for the growth of E. deflexa. Because the basal medium employed in the investigation was inadequate in carbon and nitrogen sources for G. reessii, C. serratus and A. reticulatus, the results obtained for these fungi are not conclusive. Since asparagin was employed in the basal medium as the nitrogen source rather than nitrate, the results obtained for requirement of iron may indicate that additional studies are called for.

However, the presence of both manganese and copper seemed essential for the growth of P. spiculisporem, while zinc was toxic to it. On the basis of its nutrient requirements, this species more closely resembles other species of Penicillium than it does any of the Gymnoascaceae studied.

No spectacular results were obtained from this nutritional study that would be generally applicable to support a classification which might relate all Gymnoascaceae more closely to the Aspergillaceae or to the Trichophytoneae than has been suggested by morphological studies.

64 pages. \$1.00. MicA 55-23

THE METABOLISM OF SEVERAL OXIMINO COMPOUNDS BY PLANT TISSUES

(Publication No. 10,489)

Walter Webb Heck, Ph.D.
University of Illinois, 1954

A quantitative procedure for the determination of oximino compounds has been developed. This procedure involves three separate steps: First, the hydrolysis of the oxime in 3N sulfuric acid to hydroxylamine; second, the oxidation of the hydroxylamine with an iodine-acetic acid solution to nitrous acid; third, the diazotization of the nitrous acid with sulfanilic acid and α -naphthylamine. Effects of pH, time, and sequence of addition of reagents have been studied and optimum conditions established with reference to these variables.

The following compounds were prepared by established procedures: α -Oximino butyric acid, diethyl α -oximino glutarate, and ethyl α -oximino isocaproate.

When α -oximino butyric acid was supplied to excised wheat roots some indication of oxime utilization was noted. When used in a 12 hour experiment with intact corn plants conversion of butyric oxime nitrogen to amino acid and protein nitrogen was found.

Ethyl α -oximino isocaproate caused death of the roots but an increase in both soluble and residue nitrogen was found in the shoots.

Analyses were made for nitrogenous materials soluble in 70% ethanol, residue (protein) nitrogen,

ammonia-plus-amide nitrogen and amino acid nitrogen in roots and shoots of corn plants cultured in solutions containing: 1) no nitrogen (control); 2) the glutarate oxime; and 3) ammonium chloride or ammonium sulfate. There was more nitrogen in each fraction isolated from seedlings supplied with the oxime than there was in corresponding fractions of the control plants. Plants given an ammonium salt made greater increases in the ammonia-plus-amide fraction than those in the oxime but increases in other fractions were similar.

Chromatograms of root and shoot extracts show differences primarily in alanine, glutamic acid, aspartic acid, asparagine and glutamine. Plants grown in diethyl α -oximino glutarate all exhibited extremely large increases in alanine over the control plants and in some cases most of the amino acids were increased. Glutamic acid was never shown to increase in the oxime treated plants and usually a decrease was noted.

Toxicity symptoms were seen in plants growing in 1.4×10^{-2} M diethyl α -oximino glutarate solutions for 24 hours. It is suggested that these symptoms might be due to the effects of the oxime on the lipid-protein film of cell surfaces and that the effects are magnified under conditions of rapid oxime entry.

Several mechanisms have been postulated for incorporation of the oxime nitrogen into nitrogen of amino acids and proteins. Two hypotheses which would give rise to ammonia capable of being utilized to form amino acids or proteins are: Hydrolysis of the oxime molecule to hydroxylamine, which is reduced to ammonia; and the decarboxylation of the oxime to give cyanopropionic acid, which is hydrolysed to ammonia and succinic acid. Both of these reactions fit the experimental data presented and either one or both could be operating.

There is no evidence that the oxime is reduced directly to glutamic acid.

102 pages. \$1.28. MicA 55-24

COMPARATIVE MORPHOLOGY OF THE GYMNOASCACEAE

(Publication No. 10,500)

Harold Herman Kuehn, Ph.D.
University of Illinois, 1954

A search of the literature on the Gymnoascaceae has clearly revealed that the descriptions and diagnoses often are inadequate for the purpose of identification of these fungi. Therefore, an investigation was undertaken to establish sounder bases for classification of the Gymnoascaceae. In an effort to determine whether gametangial morphology might serve as a taxonomic character for the separation of species, when used in conjunction with such other characters as the nature of the peridial appendages, 13 species of Gymnoascaceae, representing 6 genera, were studied.

Nine different gametangial types, some of them

described for the first time in this study, have been observed in the Gymnoascaceae. Some of these types have been found only in certain species, while other gametangial types were observed in several genera. This study of developmental morphology in the Gymnoascaceae represents the most extensive investigation of this type devoted to members of this family.

The type of gametangial relationship which is found most frequently in the species which have been investigated is the central, clavate antheridial type (a slender ascogonium coils about a larger antheridium). The coiling isogametangial type (two similar clavate gametangia coil mutually) is found in 4 species, and the bifurcate type (the two gametangia arise by a bifurcation of a common branch) is present in 3 species. The other types, each of which, at the present time, is known to occur in only one species, have been designated as the elongated laterally appressed type (two elongated clavate gametangia which may coil about each other slightly), the branching ascogonial type (the ascogonium and its branches coil about an antheridium), the Nannizzi type (a globose ascogonium produces many branches in the absence of an antheridium), the apically appressed type (short branches from adjacent hyphae form isogametangia which become flattened against one another at their apices), the trichogenous type (a trichogyne is produced by one of the two short, adjacent, club-like gametangia), and the Amauroascus type (the ascogonium branches irregularly while the adjacent antheridium disintegrates).

Descriptions and diagnoses are provided for the 13 species studied. Those species which had been described previously include *Gymnoascus reessii* and *Myxotrichum uncinatum* together with two other species which have been renamed in this study, *Byssochlamys trisporus* (= *Arachniotus trisporus*) and *Eidamella deflexa* (= *Myxotrichum deflexum* = *Eidamella spinosa*). Eight new species which have been described in this study are *Arachniotus reticulatus*, *Byssochlamys rosea*, *B. coremiforma*, *B. lutea*, *Gymnoascus brevisetosus*, *Myxotrichum conjugatum*, *M. emmonsii* and *M. thaxteri*. Also, one species was described that represents an undescribed genus which was isolated, but not yet named, by R. K. Benjamin.

Crozierers have been demonstrated on ascogenous hyphae in all of the species which were studied. Probably they are formed in all species of the family and may be looked upon as a characteristic of some phylogenetic significance in establishing the relationship of the Gymnoascaceae among the lower Ascomycetes. The gametangial structures of the Gymnoascaceae suggest relationship to the Endomycetaceae on the one hand and to the Aspergillaceae on the other. The production of ascogenous hyphae and crozierers, and the formation of penicillate asexual structures in some species, indicate that the Gymnoascaceae are more closely related to the Aspergillaceae, the family to which they are usually related on characteristics of mature ascocarp structure, than to the Endomycetaceae. Crozier formation is characteristic of more advanced Ascomycetes, the sub-class Euascomycetes, and are not found among the Hemiascomycetes.

134 pages. \$1.68. MicA 55-25

THE GENUS *TRIOSTEUM* (CAPRIFOLIACEAE)

(Publication No. 10,502)

Franklin Charles Lane, Ph.D.
University of Illinois, 1954

This thesis presents a world-wide monograph of the genus *Triosteum*. Included are a bibliography and description of the genus and a key to the species. The treatment of each taxon includes a bibliography, description, citation of type locality, range, notes on dates of flowering and fruiting, and common names. A discussion summarizing its identifying characters and listing the related taxa completes the taxonomic treatment.

The genus, as treated in this monograph, is composed of sixteen taxa: of which ten are considered as species, five as forms, and one as an inadequately known variety. The study of more than 1500 herbarium specimens as well as many living plants in the field and garden has led to the present treatment of the genus.

The genus is discussed as to its history, geographical distribution, generic and family relationships, morphology and anatomy, species concept and subspecific categories. A list of excluded names, a bibliography, an index to numbered exsiccatae and distributional maps and plates are presented. Other conclusions are:

(1). *Triosteum illinoense* forma *glabrescens* is described as new. This taxon differs from the typical form of the species in that the lower leaf surface is glabrous in contrast to the pubescent condition found in the typical form of the species. It is found sporadically in the species population and is most accurately treated as a forma.

(2). *Triosteum erythrocarpum* forma *nigrobaccatum* is described as a black-fruited color form of the normally red-fruited species. It developed spontaneously in the botanical garden of the University of Uppsala. The exact date is unknown. The fruits were included in a seed exchange shipment received in the fall of 1952.

(3). *Triosteum illinoense* and *Triosteum aurantiacum* are shown to be distinct from each other and from *Triosteum perfoliatum* by a series of morphological characters, and do not intergrade to any appreciable extent. They are, therefore, treated as species rather than as varieties or subspecies.

(4). The known geographical ranges of several taxa are extended. *Triosteum illinoense* and *Triosteum illinoense* forma *glabrescens* are reported from Pennsylvania for the first time. This extends the known distribution of these taxa farther east.

(5). *Triosteum angustifolium* variety *eamesii* and *Triosteum aurantiacum* variety *glaucescens* are reduced to formae since they are only minor variations occurring at random in the species populations.

164 pages. \$2.05. MicA 55-26

THE CENTROSOME IN THE
HEPATICAEE AND THE
CENTROSOME-BLEPHAROPLAST HOMOLOGY

(Publication No. 10,430)

Robert Lepper, Jr., Ph.D.
University of Connecticut, 1954

The author has investigated the spermatogenous divisions of *Marchantia polymorpha* L., *Conocephalum conicum* (L.) Wiggers, *Pellia epiphylla* (L.) Corda, *Pallavicinia lyellii* (Hook.) S. F. Gray, and *Anthoceros laevis* L. to determine whether or not centrosomes or polar bodies of any kind appeared during these divisions. Photographs of representative stages of the mitotic divisions in the antheridia are included.

Serial sections cut at four microns were prepared by the paraffin method, after treatment with several different fixatives. A number of different staining methods were employed.

The author has reviewed the pertinent literature dealing with the reported occurrence of centrosomes in plants and has considered the steps in the development and general acceptance of the centrosome-blepharoplast homology.

Some comment is made about the manner in which spermiogenesis occurs in *Pellia*.

The validity of the centrosome-blepharoplast homology is questioned and the investigations of several researchers are considered with respect to the possibility of an alternate interpretation of some of the results.

The author concludes that there are no centrosomes present in the Hepaticae, that a blepharoplast distinct from and bearing no relation to a centrosome is present, and that the blepharoplast-centrosome homology as it applies to plants should no longer be given consideration as a valid theory, until more definitive evidence than is presently at hand can be presented for it.

103 pages. \$1.29. MicA 55-27

MORPHOLOGICAL, CYTOLOGICAL, AND
TAXONOMIC OBSERVATIONS ON SPECIES OF
ENTEROBRYUS FROM THE HINDGUT OF
CERTAIN MILLIPEDS AND BEETLES

(Publication No. 10,506)

Robert William Lichtwardt, Ph.D.
University of Illinois, 1954

A study of the genus *Enterobryus* was undertaken in an effort to elucidate the morphological and biological nature of this the oldest genus belonging to a group of little-known and rather complex, phycomycetous fungi, associated with Arthropods, which are known as the Eccrinids. A comparative morphological study, adequately illustrated, was made of fifteen species of *Enterobryus* found inhabiting the

hindguts of millipeds and one species inhabiting the hindgut of Passalid beetles.

Five of the species of *Enterobryus* studied had been described and named previously: *E. elegans* Leidy, from *Spirobolus americanus* (Beauvois); *E. euryuri* Lichtwardt, from *Euryurus erythropygus* (Brandt); *E. apheloriae* Lichtwardt, from *Apheloria iowa* Chamberlin; *E. attenuatus* Leidy, from the beetle *Passalus cornutus* Fab.; *E. moniliformis* (Leidy) comb. nov., from *Scytonotus granulatus* (Say). Observations made on these species add to the knowledge of their structure and reproduction. On the basis of these observations, it has become necessary to transfer *Eccrina moniliformis* Leidy to the older genus *Enterobryus*. The validity of the genus *Eccrina* is questioned. The description of *Enterobryus attenuatus* Leidy has been emended as a result of the discovery of an additional, distinctly different, previously unrecognized type of hypha found in the anterior portion of the hindgut of the Passalid beetle. The taxonomic position of this species is shown to be in the genus *Enterobryus*, where Leidy originally placed it, rather than in either *Eccrinopsis* or *Trichella*, to which it had been assigned later by certain other investigators. Some cytological observations on *Enterobryus euryuri* are reported.

Five of the species of *Enterobryus* studied and described are considered to be new: *E. borariae*, from *Boraria carolina* (Chamberlin); *E. oxidi*, from *Oxidus gracilis* Koch; *E. cherokiae*, from *Cherokia georgiana* (Bollman); *E. ahlesi*, from *Apheloria montana* Bollman; *E. dixidesmi*, from *Dixidesmus tallulanus* Chamberlin.

Six species of *Enterobryus* which appear to be new are described, but, because of inadequate material, have not been named. They are: *Enterobryus* sp., from *Pachydesmus* sp.; *E. sp.*, from *Nannaria austriicola* Hoffman; *E. sp.*, from *Deltotaria* sp.; *E. sp.*, from *Howellaria deturkiana* (Causey); *E. sp.*, from *Rhinocricus* sp.; *E. sp.*, from *Nyssodesmus* sp.

A description of the nine different types of spores, observed in the course of this study, which are produced by these sixteen species of *Enterobryus* is provided, along with information on their method of formation, germination, and function, to the extent permitted by the material available.

The contention that species of *Enterobryus* live within the host as commensals, rather than as parasites, has been supported by morphological observations, though attempts to grow the hyphae outside the host were not successful.

The role, as a possible means of maintaining infection within the molting host, played by attachment of hyphae to the cuticula of nematodes which normally inhabit the milliped guts is reported.

A discussion of the taxonomy of the genus *Enterobryus*, and of fungi which have been related to it and classified in the Phycomycete subclass Trichomycetes, is presented.

247 pages. \$3.09. MicA 55-28

CHROMOSOMAL CONTROL OF NUCLEOLAR COMPOSITION IN MAIZE

(Publication No. 10,507)

Mei Lin, Ph.D.

University of Illinois, 1954

Nucleoli are cell organelles found almost universally in nuclei of all living organisms. They are produced at specific loci of the chromosomes and are generally believed to be concerned with the synthesis of proteins. These investigations were carried out to elucidate the relationship between chromosome constitution and nucleolar composition in the hope that it might provide some clue as to the role of the nucleolus in the physiology of the cell.

The composition of microsporocyte nucleoli of maize with different chromosomal constitutions was studied by the analysis of absorption spectra obtained from an ultraviolet microspectrophotometer. The presence of ribonucleic acids (RNA) and proteins in the nucleolus was confirmed by the presence of two broad and overlapping absorption peaks around 2637A and 2800A. The former peak was removable by treatment of the tissue sections with cold perchloric acid.

The amount of RNA per nucleolus was determined by the absorbance at 2637A and by measuring the diameter and thickness of the nucleolar sections. Correction for non-specific light loss and absorption due to proteins were effected by the use of blank slides which were subjected to cold perchloric acid extraction. The amount of RNA was found to be reasonably constant in nucleoli from the same strain in the same stage of cell division, but to vary from 7.35×10^{-12} gm. to 14.42×10^{-12} gm. in the different strains studied.

During the first division of meiosis the size of the nucleolus and its content of RNA were found to increase until mid-pachynema and then to decrease and finally disappear at late diakinesis. The increase in volume was found to lag behind that in the RNA content. This observation, together with the observation that the RNA/protein ratio went down during the same period, was interpreted as indicating that during the growth of the nucleolus the RNA content increases faster than does the protein content, and that the synthesis or incorporation of proteins into the nucleolus is dependent upon RNA. The RNA content of the nucleolus doubled at some time between mid-leptonema and zygonema, an increase which is believed to be the result of reduplication of the nucleolar organizer during leptonema.

A linear relation was established between the RNA content of the nucleolus and the number of extra nucleolar organizers present on supernumerary B⁶ chromosomes. The extra organizers did not change the RNA/protein ratio in the nucleolus. Extra heterochromatin in the supernumerary B chromosomes was found to increase the RNA content of the nucleolus only very slightly.

Extra euchromatin was believed to have no appreciable effect on nucleolar composition since the RNA content of nucleoli from triploid plants, like

that of nucleoli from plants trisomic for the nucleolar chromosome, was only three-halves as much as in their respective normal diploid siblings.

From the above results it is concluded that the nucleolar organizer is involved in the actual synthesis of nucleolar material and not merely serving in the capacity of collecting materials produced or released by the chromosomes.

The entire nucleolar chromosome is probably involved in nucleolus formation since changes in the RNA content, though not in the RNA/protein ratio, were found in plants carrying a translocation involving the nucleolar chromosome.

72 pages. \$1.00. MicA 55-29

THE EMBRYOGENY OF THE McINTOSH APPLE

(Publication No. 10,598)

Conrad Frederick Meyer, Ph.D.
Cornell University, 1954

This study is an attempt to fill the last remaining gap in the knowledge of the life cycle of apple by contributing a detailed discussion of the embryo from the zygote until the time the seed is ready to germinate. At the same time it was hoped to shed some light on the complex problem of the origin of primary meristems in an angiosperm embryo. In addition to the purely descriptive aspects of the problem an attempt was made to establish the ground work for future work in experimental morphology or physiology.

During the course of study some 20,000 apple ovules were collected. After a preliminary inspection and discarding, some 5,000 slides remained from which 300 to 400 camera lucida drawings were made. Of these 56 were chosen to illustrate the thesis.

The development of the apple embryo and ovule has been studied from the time of fertilization to maturity. It has been convenient to describe the growth of the embryo in the following stages: filamentous stage, young spherical stage, late spherical stage, heart-shaped stage, spatulate stage, and mature embryo.

The time from pollination to fertilization was about four days, and from fertilization to the first division of the zygote, three days. During the filamentous stage, which lasted ten days after fertilization, the embryo increased primarily in length. During the young spherical stage, the four distal tiers grew embryonically, that is, equally in three dimensions. This stage ended about twenty-one days after fertilization. The late spherical stage commenced with the first sign of differentiation in the cells of the embryo and ended about twenty-four days after fertilization with the emergence of the cotyledonary primordia. Heart-shaped embryos were first seen on the twenty-fourth or twenty-fifth day after fertilization. Spatulate embryos appeared on about the twenty-sixth day, and this stage-designation was applied until the time when the embryo ceased to grow, about sixty days after fertilization. Thenceforth the

embryo was designated as mature. It was during the spatulate stage that the cotyledons and hypocotyl increased greatly in length.

This paper shows that in apple the tissues begin to differentiate in the following sequence: the outer ground meristem, the inner ground meristem, the root cap and protoderm, and the procambium.

This thesis supports the concept that the promeristem of the growing points is residual meristem which consists of undifferentiated cells derived from the embryo.

The root promeristem consists of a group of undifferentiated embryonic cells and not one or more layers of differentiated initials.

The results of overlays made from a number of camera lucida drawings of longitudinal sections indicate that maximum growth and cell division of the spherical embryo is at the distal end with little growth in the region of the suspensor.

This paper presents a clearer discussion of the direction in which vacuolation and other aspects of differentiation of the inner and outer ground meristems proceed than any other embryological study that the writer has been able to find in the literature. It also confirms the complex nature of the outer ground meristem, a concept which has been suggested by other workers.

It is suggested that the epicotyl maintains a continuing residual meristem connection from the initial stages of differentiation until the embryo is mature. Xylary and phloic procambia differentiate in the cotyledonary primordia when they are about 800 microns long.

The apple embryo is contrasted with those of *Juglans*, *Zea*, *Phlox*, and *Dianthus* with the result that the differences outweigh the similarities.

156 pages. \$1.95. MicA 55-30

THE EFFECT OF CERTAIN METABOLITES AND FUNGICIDES ON *STEMPHYLIUM* SPP.

(Publication No. 10,521)

Patrick Martin Miller, Ph.D.
University of Illinois, 1954

Stemphylium sarcinaeforme (Cav.) Wiltshire and *S. solani* Weber were studied in the laboratory to determine their relative responses to fungicides and other toxicants. Small glass shell vials and glass microscope slides were utilized for spore germination experiments. The criterion for germination was the degree of germ-tube elongation.

S. sarcinaeforme and *S. solani* gave qualitatively similar but quantitatively different reactions to proprietary fungicides, metabolites, and metabolic inhibitors, with *S. solani* being generally the more resistant to toxicants. Hydrogen ion concentrations between pH 4.2 and 7.0 and temperatures between 25-30° C. had no consistent effect on fungitoxicity of zineb and ziram. *S. solani* was less susceptible to zineb at 13° C. than was *S. sarcinaeforme*.

Exposure for 15 minutes to temperatures of 50° C. or above inhibited spore germination of both species. Short exposures to temperatures above 30° C. increased the susceptibility of *S. solani* to zineb but freezing for an hour decreased it.

The two species generally reacted similarly to zineb-metabolite mixtures, with concentration of the metabolite one of the regulating factors. Compounds containing sulfhydryl groups; certain proteolytic enzymes such as pepsin, proteinase and trypsinogen; other enzymes such as lipase and pectinase; and also sodium bisulfite decreased zineb toxicity whereas sodium thiosulfate increased it. Cozymase and L arginine (free base) increased zineb toxicity in certain instances but the results were not always predictable with *S. sarcinaeforme*. Certain metabolite-ziram mixtures affected the two species differently, but a slight, masked toxicity of the metabolite might have accounted in part for the increase in toxicity. L cysteine (free base) and DL histidine monohydrochloride in water increased ziram toxicity to *S. sarcinaeforme* but decreased it to *S. solani*. The increase by histidine was lost if the suspension was adjusted to pH 6.5. L arginine (free base) and sodium thiosulfate decreased ziram toxicity to both species. Spores alone or combined with dilute concentrations of ziram or zineb had little effect upon changes in pH of metabolite solutions. However, spores of the two species differed in their effects on the pH of certain metabolite or metabolite-fungicide mixtures.

Extracts and fractions from spores, mycelium, pork liver, tomato tissues, and germination water markedly affected fungitoxicity of zineb and ziram. The two species reacted alike to certain fractions and differently to others. Similar fractions from spores or mycelium of the two fungi gave like and also different reactions depending upon the fraction and fungicide. Fractions from spores or mycelia of the same fungus had like or unlike effects upon fungitoxicity of zineb and ziram. The tomato tissue extracts generally decreased fungitoxicity more to *S. solani* than to *S. sarcinaeforme*. Pork liver was found to contain anti-fungicidal substances.

105 pages. \$1.31. MicA 55-31

AUXIN AND ANTIAUXIN-INDUCED CHANGES IN THE UTILIZATION OF C¹⁴ LABELED ACETATE AND PYRUVATE BY PLANT TISSUES

(Publication No. 10,531)

Irwin Bernard Perlis, Ph.D.
University of Illinois, 1954

The effects of indoleacetic acid (IAA) and trans-cinnamic acid (TCA) on the utilization of acetate-1-C¹⁴ by pea stems and the effects of IAA on the utilization of pyruvate-2-C¹⁴ and acetate-1-C¹⁴ by wheat roots are reported in this study. A concentration of IAA that inhibits wheat root growth is shown to inhibit the entry of labeled pyruvate into malic acid, soluble sugars and cell-wall components exclusive

of α -cellulose. In this 6 hour experiment cellulose synthesis from the radioactive metabolite is stimulated twofold.

In 4 hour, 2 hour, and half-hour experiments on wheat roots with growth inhibiting concentrations of IAA, acetate utilization is seen to be decreased as a whole. Enhanced lipid and cellulose formation is evident as is the synthesis of an ethanol soluble protein fraction. IAA is found to greatly inhibit acetate entry into organic acids and polyuronide hemicelluloses.

With pea stem sections, most of which are incapable of enlarging in response to added IAA, malic acid and water insoluble protein syntheses from acetate are found to be enhanced in 6 hours time. All cell-wall components show lower activities as a result of IAA treatment, an obvious inhibition of labeled acetate incorporation. Trans-cinnamic acid, on the other hand, inhibits acetate entry into malic acid and into polyuronide hemicelluloses, while stimulating its incorporation into cellulose and non-cellulosic polysaccharides in this same tissue.

Pea stem sections, most of which are stimulated to elongate by added IAA, respond also by showing enhanced formation of cellulose, pectins, polyuronide hemicelluloses and lipids from labeled acetate. In a similar 2 hour experiment, pretreatment with IAA before the addition of the labeled substrate, results in a decreased stimulation of all the above mentioned syntheses with the exception of that of cellulose. Upon pretreatment, malic acid formation is increased by IAA, where no effect is obvious with simultaneous acetate-IAA incubation.

Respiration of wheat roots is inhibited or unaffected by additions of IAA, while both IAA and TCA cause slight increases in respiratory activity of pea stems.

In the light of certain experimental deficiencies in this as well as in previous studies of this kind, no claims can be made from these results as to the mechanism of auxin action. It is interesting, however, that many chemical effects previously noticed or postulated as a result of auxin activity, are verified in this work. The suggestion is made, based on a number of obvious considerations, that if the mechanism of auxin action is to be deduced by studying chemical changes in tissues accompanying growth substance application, then the tissue used must consist of cells all of which are capable of exactly the same responses.

98 pages. \$1.23. MicA 55-32

EFFECTS OF IONIZING RADIATIONS,
ULTRASOUND, AND SEVERAL CHEMICALS
ON THE OAK WILT FUNGUS

(Publication No. 10,568)

Bert Merton Zuckerman, Ph.D.
University of Illinois, 1954

The effects of ionizing radiations and several chemicals upon certain properties of the oak wilt fungus have been investigated.

X radiation permanently inactivated 50 per cent of the conidia at dosages of $16,500 \pm 2,500r$. As dosage was increased, the number of conidia which germinated decreased. Also, as dosage was increased, the time lapse prior to maximum germination and secondary spore production increased. When a dosage of 50,000r was exceeded, germinated spores did not give rise to secondary conidia. Unirradiated spores produced germ tubes 20 to 30 times the lengths of the spores within 36 hours. After exposure to dosages of from 30,000r to 80,000r most of the conidia that germinated produced germ tubes which attained maximum lengths of 2 to 6 times the length of the parent spore. At dosages of from 50,000r to 110,000r many conidia formed short knob-like projections and then ceased developing. Growth of the fungus in a liquid medium and the ability of the fungus to produce a metabolite toxic to oak and tomato cuttings was not altered by X radiation. The pH change followed the same course in irradiated cultures as in control cultures. Irradiated cultures were pathogenic and, when crossed with isolates of a compatible strain, produced fertile perithecia. Morphological variations occurred in a ratio of three mutants in irradiated cultures to one in control cultures. Mutant sectors were tested and all proved to be pathogenic.

The type or amount of exometabolite formation by the oak wilt fungus was not altered by X radiation. As the pathogenicity of the fungus was not altered, the results do not show whether or not exometabolites form the basis of pathogenicity of the fungus. The reproductive capacity of the fungus was inhibited at dosages which permitted growth to take place.

Irradiation with a mixed alpha source, uranium

238, resulted in death of the oak wilt fungus. Therapy, using uranium as an external source of radiation, was unsuccessful. Uranium nitrate, when injected into wilt-infected seedling oaks, did not halt the progress of the disease but appeared to retard initial symptom expression. The lowest concentration of uranium nitrate used caused leaf injury but did not result in death of the host.

The wilt fungus was subjected to several dosage levels of ultrasound. As shown by comparison of control and irradiated cultures, ultrasound did not affect rate or percentage of germination of conidia, growth in liquid media, exometabolite production as assayed by pH change in the medium and toxicity of cultural filtrates, pathogenicity, or ability to form fertile perithecia.

The author could find no reference to ultrasonic irradiation of fungi *in vitro*. Several workers have reported on the deleterious effects of ultrasound to bacteria and certain plant tissues. In these cases there was not indication that internal temperature was measured. The internal temperature effect was carefully estimated in the current work. The oak wilt fungus was insensitive to the ultrasonic dosages attained in this experiment.

The fungus was grown in several concentrations of each of three chemotherapeutants and uranium nitrate. Exometabolite production and pathogenicity were not altered by these treatments. Sublethal concentrations of the chemotherapeutants did not affect the amount of growth of the fungus, except in the M4367 test. In this case growth of the fungus was inhibited at a concentration of 1.0 ppm, but at 0.1 ppm growth was accelerated. No reason can be given for these results. M4367 exhibited a high fungitoxicity previously unrecorded for this compound. The fungus was totally inhibited by concentrations of 5.0 ppm of the chemical.

The fungus was reisolated from the year-old wood of a tree which had been successfully treated with M4367, and growth, exometabolite production, pathogenicity and ability to form fertile perithecia were studied. None of these qualities had been altered by contact with the chemotherapeutant within the tree.

99 pages. \$1.24. MicA 55-33

CHEMISTRY

CHEMISTRY, GENERAL

I. A NEW RUBY GLASS FOR THE PROTECTION OF CHEMICAL SYSTEMS SENSITIVE TO LIGHT AND HIGH ENERGY RADIATION. II. A CRITICAL ANALYTICAL CHEMICAL STUDY OF LIGHT ACTIVATED FLAVOR IN MILK. III. AN X-RAY DIFFRACTION AND ELECTRON MICROSCOPIC STUDY OF POSITIVE LEAD STORAGE BATTERY PLATES.

(Publication No. 10,447)

Stanley Anthony Bartkiewicz, Ph.D.
University of Illinois, 1954

I. A NEW RUBY GLASS FOR THE PROTECTION OF CHEMICAL SYSTEMS SENSITIVE TO LIGHT AND HIGH ENERGY RADIATION.

A new copper-ruby glass for the protection of light sensitive systems has been developed on a laboratory scale. The object of this invention is to provide a method for preparing copper-ruby glass without the addition of a cyanogen compound and bismuth to the glass batch. This may be accomplished by adding a suitable oxalate compound to a glass batch which contains, in addition to the usual batch ingredients, a copper compound - thereafter fusing the resulting mix. After pouring and cooling, the ruby color is developed in the virtually colorless glass by reheating for one-half hour at 600° C. Difficulty in obtaining a homogeneous product was overcome to some extent by first fritting the glass batch before the addition of the copper and oxalate compounds. Sodium and potassium oxalates were proven to be very satisfactory. Transmission curves obtained with the Cary Recording Spectrophotometer and the Perkin-Elmer Model 21 Double Beam Recording Infrared Spectrophotometer have shown that the new glass has a transmission band only in the 600 to 2800 mu region. Samples of cinnamic aldehyde irradiated with and without the protection of the new glass have exhibited without a doubt the protective properties of the glass.

II. A CRITICAL ANALYTICAL CHEMICAL STUDY OF LIGHT ACTIVATED FLAVOR IN MILK.

The photochemical deterioration of milk, with particular emphasis upon the possible formation of hydrogen sulfide, has been extensively studied with the thought in mind of developing an objective chemical method of analysis so sensitive that it may compete with the extraordinarily sensitive but highly subjective organoleptic detection. The method in which

methylene blue is formed when hydrogen sulfide reacts with *p*-aminodimethylaniline and ferric chloride was critically examined. The interferences offered by the milk proteins were, however, too difficult to be overcome. Although 3.5 micrograms of hydrogen sulfide were found per 500-ml. of fresh, pasteurized-homogenized milk, no increase in hydrogen sulfide concentration could be detected upon irradiation. To eliminate interference from the milk proteins, the γ -lactoglobulin fraction of milk was isolated and investigated. An aqueous solution of γ -lactoglobulin, upon irradiation in sunlight, developed an odor and taste characteristic of irradiated milk. No hydrogen sulfide could, however, be detected. Ruby glass containers were found to inhibit the development of a burnt flavor and odor in an aqueous solution of γ -lactoglobulin. From the above studies it may be concluded that the sulfur like odor which develops when milk is irradiated by strong sunlight is due to decomposition products other than hydrogen sulfide.

III. AN X-RAY DIFFRACTION AND ELECTRON MICROSCOPIC STUDY OF POSITIVE LEAD STORAGE BATTERY PLATES.

Repeated efforts have been made to secure satisfactory electron micrographs of storage battery plates, but without success. Most of the trials have been made to obtain replicas which could be shadow-cast and then examined in the microscope; but, the plates are too spongy to permit separation of coherent and faithful replicas, although every known medium for preparing such replicas has been tried. Furthermore, attempts to microtome this section of the active mass of the plates have invariably met with failure because of the brittleness and friability of this material. In the present investigation, the first successful technique ever found anywhere has been developed; and, this technique of specimen preparation is described and the results are illustrated with a few examples of "cured" positive plates. With this technique universities and industrial laboratories may proceed to the investigation of many unsolved problems in the theory, operation, and practical behavior of the lead-acid storage battery.

83 pages. \$1.04. MicA 55-34

CHEMISTRY, BIOLOGICAL

THE USE OF ION EXCHANGE RESIN MEMBRANE ELECTRODES IN THE STUDY OF THE INORGANIC EQUILIBRIA OF MILK

(Publication No. 10,096)

Harold Edwin Affsprung, Ph.D.
University of Missouri, 1954

Supervisor: Charles W. Gehrke

This research dealt with the direct influence of the salts common to milk upon the colloidal stability of casein and interactions of calcium ions with casein. This information will enable a better understanding of the various effects of processing upon the protein stability of milk products. The major objectives were: a. the preparation of ion exchange resin membrane electrodes suitable for the determination of the cationic and anionic activity of raw skim milk. b. the effect of added salts and of dilution with water upon the activity of milk. c. The extent of any interaction of the calcium salts, CaCl_2 , CaHCit , $\text{Ca}(\text{H}_2\text{Cit})_2$, and $\text{Ca}(\text{H}_2\text{PO}_4)_2$, and suspensions of ion-free casein. d. the effect of heat treatments upon the activity of the calcium salts mentioned above when in suspensions of ion-free casein.

Cation sensitive membrane electrodes were prepared which would give a satisfactory value for the cationic activity in milk. Anion sensitive membranes were less successful, but they did give an estimate of the anionic activity in milk. Clay membranes which were selective for monovalent cations were also used.

A generalized activity coefficient for milk of 0.75 was calculated from total activity measurements and the sodium and potassium content of milk. This was in agreement with an activity coefficient of 0.72 calculated from potential measurements on a ternary solution of the chloride salts of the cations common to milk.

Potential measurements made on milks which had been equilibrated with cation and anion exchange resins showed that the phosphate which is in true solution in milk, about one-sixth of the total, is present as the monohydrogen ion.

Potential measurements made on milks which were diluted with water showed that milk contains a reservoir of inorganic materials. It was found that a 5% dilution could be detected and that an 8% dilution produced a significant decrease in potential.

Potassium, sodium, and calcium chloride were added to raw skim milk and the changes in potential measured. The additions of the salts in the concentration range 0.02 to 0.20 eq./l. showed that these ions did not react with any of the other constituents of milk.

Potential measurements were made on solutions of the calcium salts, CaCl_2 , CaHCit , $\text{Ca}(\text{H}_2\text{Cit})_2$, and $\text{Ca}(\text{H}_2\text{PO}_4)_2$ from 0.002 to 0.01 molar in ion-free casein suspensions. The pH of the suspensions varied from 3.5 to 4.9. The experimental data showed that the effect of the calcium ion on casein,

as it normally occurs in milk, is small and similar to that of any divalent ion upon a hydrophobic colloid.

The addition of citrate and phosphate salts to casein suspensions gave experimental potentials slightly higher than those predicted. The increase in cationic activity was probably due to an anion exchange taking place between the multivalent anions and chloride ions from the surface of the casein particles. An exchange reaction of this type would increase the activity of the calcium ion and explain the stability of the casein suspensions to heat when calcium salts of citric and phosphoric acid were added. The suspensions of casein with calcium chloride gave potentials which were very near the theoretical even though in every case the casein coagulated.

The necessary conclusion regarding a chemical reaction between calcium ions and casein, is that, in the pH range investigated, no such reaction occurs. The effect of the addition of an excess of calcium ions upon the stability of milk is indirect in that the calcium ions remove or complex the stabilizing citrate and phosphate ions and reduces the zeta potential to the point where the casein coagulates.

139 pages. \$1.74. MicA 55-35

THE CHEMISTRY OF NEAMINE

(Publication No. 10,467)

John Robert Dyer, Ph.D.
University of Illinois, 1954

The antibiotics of the neomycin complex are produced by a culture of *Streptomyces fradiae*. Although toxicity has prevented the indiscriminate use of these substances, some clinical applications have been developed. In our laboratories studies on the chemistry of the neomycin complex have been carried out and results obtained with neamine, a biologically active degradation product of neomycin B and C, are reported in this thesis.

Crystalline neamine has been isolated in good yield by degradation of neomycin sulfate. A molecular formula of $\text{C}_{12}\text{H}_{24}\text{O}_6\text{N}_4$ for neamine has been established on the basis of analytical data and properties of neamine and its derivatives. Crystalline N, N', N'', N'''-tetrabenzoylneamine and poly-O-acetyl-N, N', N'', N'''-tetrabenzoylneamine have been prepared. Analysis of the poly-O-acetyl derivative indicated four O-acetyl groups to be present.

Neamine was found to exhibit a remarkable stability to acid hydrolysis. 2-Desoxystreptamine dihydrobromide is stable toward strong acids and has been isolated from the hydrolysate. Hydrolytic conditions sufficiently vigorous to cleave neamine result in extensive degradation of that portion of the molecule attached to 2-desoxystreptamine. Acid hydrolysis leads to the production of an ultraviolet spectrum which may be due to the presence of a pyrole.

Acyl migration studies on the N-benzoyl derivatives

of 2-desoxystreptamine and neamine have shown there to be no *cis* aminoalcohol group present. An all *trans* configuration has been indicated for 2-desoxystreptamine.

The reaction of neamine with 0.01M periodate has been investigated. Four moles of periodate are rapidly reduced, resulting in the liberation of two moles of formic acid, two moles of free ammonia, and no formaldehyde. One mole of alkali-labile nitrogen is produced.

The reaction of neamine with 0.1M periodate has been studied. Seven or eight moles of periodate are reduced, resulting in the liberation of approximately four moles of formic acid, two moles of free ammonia, and part of a mole of formaldehyde. One mole of alkali-labile nitrogen is produced. Following hydrolysis of the periodate product from the reaction of four moles of 0.1M periodate with neamine, derivatives of glyoxal and glycine were isolated.

The reaction of N, N', N'', N'''-tetrabenzoyl-neamine with 0.01M periodate proceeds with the reduction of one mole of oxidant with moderate selectivity. The resulting aldehyde was oxidized by neutral permanganate to yield a diacid.

The reaction of N, N', N'', N'''-tetrabenzoyl-neamine with 0.1M periodic acid proceeds with excellent selectivity. One mole of formic acid is liberated by this reaction. The resulting aldehyde was oxidized by neutral permanganate to yield a diacid.

Several attempts to detect a carbonyl function in neamine are recorded. The resulting evidence favors the presence of a tertiary formyl group.

A structure for neamine consistent with most of the available data is discussed.

253 pages. \$3.16. MicA 55-36

INSULIN- METAL COMPLEXES

(Publication No. 10,473)

Robert Leigh Fischer, Ph.D.
University of Illinois, 1954

The existence of a relationship between metals and insulin has been shown by previous workers. The data presented in this thesis are the result of a study of the interaction of zinc, cobalt and iron with insulin. The techniques of equilibrium dialysis, electrophoresis, ultracentrifugation, and measurement of ultraviolet absorption have been used. The role of zinc in the polymerization of insulin monomer units has been investigated. A rapid and simple method of metal analysis involving the use of radioactive tracers contributed much toward this study. For these experiments, amorphous insulin of very low zinc content (Lot W-1302) was supplied by Eli Lilly and Company to whom the author is indebted.

Electrophoretic studies of amorphous insulin at neutral pH consistently showed the presence of two principal components. The percentage of the faster moving component decreased as the concentration was raised from 0.1 per cent to 1.0 per cent. These

components would necessarily differ from each other by increments of negative charge. A concentration dependence of the electrophoretic mobility of each component was demonstrated. Although ultracentrifugal studies of amorphous insulin did not show the presence of two components, an increase in the sedimentation constant with an increase in concentration was noted. This demonstrates that, as the concentration is increased, there is an increase in the mass accompanied by an increase in the total net charge on the insulin particles. This could be accomplished by an intermolecular bonding between the insulin sub-units.

Zinc-insulin complexes prepared by equilibrium dialysis showed the presence of only one electrophoretic component. This result was obtained even when such small amounts as 0.2 moles of zinc per mole of insulin were bound. There was a marked increase in mobility with an increase in bound zinc. After the amount of bound zinc exceeded a value of about one mole of zinc per mole of insulin, there was a tendency for the mobility to decrease.

Ultracentrifugal studies showed a sharp early rise in the sedimentation constant accompanying the binding of small amounts of zinc. However, no further increase was demonstrated until a value of about 0.7 moles of zinc per mole of insulin was reached. At this point, the sedimentation constant began to rise again in a somewhat linear fashion.

The above electrophoretic and ultracentrifugal results indicate that the binding of small amounts of zinc causes both the mass and the charge to increase. Further binding increases the net negative charge but the size remains about constant. After about one mole of zinc is bound, the total net negative charge decreases, but the size increases. This latter finding indicates an aggregation of zinc-insulin complexes.

Experiments with the binding of small amounts of cobalt by amorphous insulin in general paralleled the experiments with zinc, but cobalt was less tightly bound than zinc. However, iron binding failed to cause the disappearance of the faster moving electrophoretic component, and there was a decrease in the mobility when more than 0.4 moles of iron per mole of insulin were bound. These results indicate that there are marked differences between the interaction of zinc and cobalt with insulin on the one hand, and iron on the other. It seems quite possible that there may be physiological, as well as physico-chemical, significance attached to the rather striking ease of formation of zinc-insulin complexes.

67 pages. \$1.00. MicA 55-37

PHOSPHOPROTEIN PHOSPHATASE
IN THE CHICK EMBRYO

(Publication No. 10,427)

Murray Wilbur Foote, Ph.D.
University of Connecticut, 1954

There have been many attempts to show that enzyme preparations which are capable of catalyzing the hydrolysis of simple esters of orthophosphoric acid will also dephosphorylate phosphoproteins such as casein. In general these attempts have been unsuccessful although there have been sporadic reports which indicate that homogenates of the frog egg and mammalian spleen possess both types of enzyme activity: The question of the existence of a specific enzyme which will dephosphorylate only phosphoproteins has not been resolved since no purified enzyme with only phosphoprotein phosphatase activity has hitherto been prepared. The purpose of the present work has been to prepare a highly active and specific phosphoprotein phosphatase and to examine some of its properties. This purpose has been achieved and a new source of the enzyme has been discovered.

Both the yolk sac and embryo of the hen's egg were found to show phosphoprotein phosphatase activity in that extracts of these tissues would catalyze the release of inorganic phosphate from casein. The embryos exhibited activity at ages from four to seventeen days. A suitable yield of enzyme may be obtained from eleven to thirteen day embryos without sacrifice of workability.

The method of preparation utilizes an acetone powder of chick embryo tissue which is subjected to subsequent acetone and ammonium sulfate fractionations. These procedures yield a water soluble white powder which is enzymatically active and stable for at least several months when stored *in vacuo* at 0° C. The enzyme is capable of catalyzing the release of 2500 μ g. of inorganic phosphorus from casein per mg. of enzyme nitrogen in fifteen minutes at 37°C and at pH 5.8. An overall yield of twenty per cent is obtainable by the method and a twenty-five fold increase in activity is achieved.

Studies of the substrate specificity of the enzyme show that the preparation is active against unfractionated casein, α -casein, β -casein, phosvitin, and a phosphopeptone prepared by tryptic hydrolysis of casein. No activity is observed against simple esters of phosphoric acid and therefore the enzyme may be properly termed a phosphoprotein phosphatase. The release of inorganic phosphate is not accompanied by an increase in acid-soluble nitrogen during incubation thus giving support to the assumption that there is no proteolysis accompanying the dephosphorylation process.

The enzyme is capable of completely dephosphorylating casein and the phosphopeptone derived therefrom. The rate curve for dephosphorylation of casein shows a break at seventy-five per cent hydrolysis. The break may represent the difference in specificity toward the α - and β -components of casein, a difference which was observed in the specificity studies.

Although it was suspected that the metabolic role

of the enzyme might involve a transphosphorylating function, studies with the purified preparation did not provide any support for such a function. The enzyme is incapable of catalyzing a transfer of phosphate from casein to glucose, glycerol, methanol, or to serine under conditions employed in *in vitro* experiments.

The availability of a purified phosphoprotein phosphatase makes it possible to investigate the function of the enzyme during the growth and development of the chick and, in addition, the preparation may prove to be a potent tool in the investigation of the structure of phosphoproteins and their products of hydrolysis.

71 pages. \$1.00. MicA 55-38

THE APPLICATIONS OF PAPER PARTITION
CHROMATOGRAPHY TO IDENTIFY OFF-FLAVOR
AND ODOR CONSTITUENTS IN
STORED DEHYDRATED PORK

(Publication No. 10,111)

Henry Nobuyoshi Fukui, Ph.D.
University of Missouri, 1954

Adviser: Dr. C. W. Gehrke

When dehydrated pork was stored a characteristic off-flavor was produced. One of the objects of this study was to determine the types of molecules causing this off-flavor.

A modified Hall-Somogyi method for the quantitative determination of reducing sugars was employed. The average value for the reducing sugars was 67 mg. per 100 grams of dehydrated pork prepared in 1951.

The Van Slyke (129) quantitative ninhydrin method for the determination of free amino acids was applied to extracts of dehydrated pork. The samples prepared in 1951 contained from 0.12 to 0.46 mg. of "carboxyl nitrogen", free amino acids, per gram of meat.

In an effort to obtain volatile constituents of dehydrated pork aerations and vacuum distillations were made with traps immersed in brine-ice, acetone-dry ice, and liquid air. Among the substances entrapped and identified were methylamine, ammonia, and carbonyl compounds.

Steam distillations of dehydrated pork samples were made into acid, alkaline, and 2,4-dinitrophenylhydrazine solutions in an effort to obtain amines, volatile organic acids, and carbonyl compounds, respectively. Methylamine was found in samples stored at 100° F. No volatile organic acids were detected. Acetaldehyde and an unknown dicarbonyl compound were found in samples stored at -20° F. and 100° F. for 2 years.

The following paper chromatographic methods were used and developed for the study of the different class of compounds:

Carbohydrates. Whatman No. 1 and Schleicher and Schuell 595 filter papers were used. Phenol saturated with water was used as the first phase while butanol-acetic acid-water was used as the second phase. A

mixture of aniline-phthalic acid in ethanol was used as the spraying agent for aldoses, while orcinol plus trichloroacetic acid in butanol was employed for ketoses. Glucose and galactose were found in eighty per cent alcoholic extracts of dehydrated pork samples stored 16 weeks at -20°F . and 100°F . A trace of mannose was found in the latter sample. No ketoses were found in these samples.

Amine hydrochlorides. Whatman No. 1 and Schleicher and Schuell 595 filter papers were employed. The solvent mixture used with the former paper was n-butanol-acetic acid-water (4:1:5 v/v) was used with the latter. The spraying solutions utilized were bromphenol blue and bromcresol green. The average Rf values of a number of amine hydrochlorides are presented.

Carbonyl compounds. A large number of 2,4-dinitrophenylhydrazine and p-nitrophenylhydrazine derivatives of carbonyl compounds were prepared. The melting points of the derivatives were compared with the literature values. The average Rf values of the derivatives were determined on Whatman No. 1 filter paper in n-heptane saturated with absolute methanol and absolute methanol saturated with n-heptane.

Amino acids. The same filter papers and solvent mixtures utilized for the carbohydrate studies were employed for the two-dimensional chromatography of amino acids. The spraying solution consisted of ninhydrin in ethanol. The following amino acids were found in all samples of dehydrated pork: cysteine; glutamic acid; glycine and/or serine; leucine, isoleucine, and/or phenylalanine; lysine; threonine; alanine; tryptophane and/or valine; and two unknown spots designated numbers 22 and 23.

Volatile organic acids. Volatile organic acids were chromatographed as the ammonium salts on Whatman No. 1 filter paper using the solvent mixture of n-butanol saturated with 1.5 N ammonium hydroxide. The spraying agent was bromphenol blue in ethanol.

Non-volatile organic acids. Non-volatile organic acids were chromatographed in two ways: (1) on Whatman No. 1 filter paper using the solvent mixture of ethyl ether-acetic acid-water (13:3:1 v/v).

(2) Schleicher and Schuell 595 filter paper was used with the solvent mixture of n-butanol-acetic acid-water (4:1:5 v/v). The spraying reagent for both methods was bromcresol green in ethanol.

Lactic acid was found in samples of dehydrated pork stored for 12 months at -20°F . and 100°F .

100 pages. \$1.25. MicA 55-39

A STUDY OF THE INORGANIC CONSTITUENTS IN THE BLOOD AND URINE OF DAIRY COWS UNDER THERMAL STRESS AND RADIATION

(Publication No. 10,112)

Cecil Kunar Goberdhan, Ph.D.
University of Missouri, 1954

Supervisor: Charles W. Gehrke

A study was made of the changes in the concentration of the major inorganic constituents of the blood and urine of dairy cattle which were subjected to thermal stress and radiation. The experimental design involved the use of a climatic laboratory in which the air temperature and light intensity were rigidly controlled.

The experimental animals consisted of six Holsteins, four Jerseys and one Barzee Brahman. They were exposed first to a temperature of 45°F . and the light intensity increased from dim (7 B.T.U. sq. ft./hr.) to one-half (90 B.T.U. sq. ft./hr.) and finally to full intensity (180 B.T.U. sq. ft./hr.). This procedure was repeated at 70 and 80°F . Each of the above variations in climatic conditions, was maintained for a period of seven days.

Blood was collected from the jugular vein on the fourth day of each seven day period, centrifuged, and the plasma analyzed for sodium, potassium, calcium, magnesium, sulphate, phosphate, and chloride. The urine was collected for twenty-four hour periods and analysis made for the same constituents determined in the blood, and in addition, carbonate.

The methods of analysis used were standard, or adaptations of standard procedures as recorded in the literature. In brief sodium and potassium in the plasma and urine, and calcium in urine, were determined by flame photometry; calcium in the plasma by versenate titration; magnesium in plasma and urine by a colorimetric thiazole yellow method; phosphate in plasma and urine by the method of Fiske and Subbarow; chlorides in both plasma and urine by iodometric titration, and carbonate in the urine by the use of the Van Slyke manometric apparatus.

Significant changes in the concentrations of the inorganic constituents investigated were found under changing conditions of temperature and radiation. In general the influence of temperature was much greater than that of radiation. Significant differences in response to increasing temperature and increasing radiation, and to both increasing temperature and radiation were observed between the breeds. The smaller Jerseys, generally evidenced changes in concentration of the constituents earlier than the larger Holsteins, indicating that they were more easily affected by the changing environmental conditions. While in some cases the changes in the concentration of the constituents were not consistent due perhaps to variation among the different animals, yet there is in general, a definite tendency to retain sodium, potassium, calcium, phosphate, chloride, and carbonate when the environmental temperature was raised from 45 to 70°F . This is evidenced by

the decreased excretion of these constituents in the urine, and their increased concentration in the blood. Magnesium declined in both blood and urine indicating that this element was either eliminated in the feces or diffused into the red blood cells. This however was not confirmed.

As the temperature was further increased to 80°F. the concentration of chloride in the plasma increased; but the potassium, sodium, and sulphate level decreased. At this temperature breed differences were evident. For instance, the calcium and phosphate levels in the Holsteins increased while in the Jerseys these constituents decreased.

The urinary excretion of the constituents investigated changed rapidly with the elevation of the temperature from 70 to 80°F. Carbonate, chloride, and phosphate were no longer being retained nor were the calcium and potassium; sodium and magnesium continued to decline as they did at 70°F.

These findings suggest that the inorganic constituents of the blood and urine of the dairy cattle investigated in general reflect the stress both thermal and radiant, under which the animals were kept.

151 pages. \$1.89. MicA 55-40

STUDIES ON IN VITRO METABOLISM OF THE RAT MAMMARY GLAND AND SOME OBSERVATIONS ON IN VITRO ACTIONS OF THYROID HORMONES

(Publication No. 10,116)

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University of Missouri, 1954

Supervisor: C. W. Turner

The following topics were discussed: (1) The uniqueness of the mammary gland as a material for experimental studies of growth, secretion, and aging especially in terms of metabolic control and the possible role of hormones thereon. (2) Carbohydrate, fat, phosphorus, and nitrogen intermediary metabolism of the mammary gland and its direct hormonal alteration. (3) Mechanism of thyroid hormones action.

In vitro respiration, aerobic glycolysis, and "metabolic" CO₂ production (R. Q. calculated) per unit nitrogen of rat mammary gland tissue in various physiological states was studied in detail. It was found that these processes were closely related to the physiological state. Both oxygen consumption and "metabolic" CO₂ production increased through the first half of pregnancy, increased dramatically following parturition (the latter greater than the former), and fell upon tissue involution. Aerobic acid production was low throughout the reproductive cycle except for somewhat of an increase during the latter part of pregnancy, early lactation, and especially upon involution where its index approached the index for respiration. Although some very high R. Q. values were observed on tissues from virgin animals, they were in general below one throughout pregnancy,

whereupon they increased to ca. 1.7 in ca. 9 days of lactation. In general the R. Q. was below one for tissue which had involuted.

Adenosine triphosphate synthesis was studied in lactating rat mammary gland homogenates and fractions thereof. Certain whole homogenates and "washed residues" were unable to take up inorganic phosphate in presence of a hexokinase system, for trapping adenosine triphosphate, and some members of the Krebs cycle. The system oxidized succinate to some extent. Some other members of the Krebs cycle were not or only slowly oxidized by such preparations. Similar preparations from rat liver did carry these enzymic activities. This mammary gland system was effective in taking up inorganic phosphate in presence of hexose diphosphate. Moniodoacetic acid obliterated the phosphate uptake and depressed oxygen consumption below the endogenous level. This suggests that the mammary gland dismutates hexose diphosphate into trioses. Sedimentable residues from homogenates were found to oxidize some Krebs cycle intermediates when prepared in presence of the chelating agent, ethylenediaminetetraacetic acid. In presence of α -ketoglutarate oxidative phosphorylation was demonstrated and in which case, 2, 4-dinitrophenol depressed the P:O ratio.

The direct in vitro influence of 3, 5, 3'-L-triiodothyronine and to a less extent, L-thyroxine on some metabolic processes was studied. Q_O of normal rat liver slices incubated one hour in presence of triiodothyronine (10⁻⁵ M) was increased ca. 11%. Other concentrations produced less or no effect as was true for similar studies made on such from hypothyroid animals. No effect could be found on glucose, succinate, or pyruvate oxidation by rat kidney slices. Other negative findings were recorded. P:O ratio of rat liver homogenate residues in presence of α -ketoglutarate were increased by in vitro presence of triiodothyronine. The same concentrations of thyroxine were essentially without effect.

145 pages. \$1.81. MicA 55-41

THE METABOLIC FATE OF 3-HYDROXYANTHRANILIC ACID

(Publication No. 10,509)

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University of Illinois, 1954

INTRODUCTION

It was shown using *Neurospora crassa* mutants that 3-hydroxyanthranilic acid participates as an intermediate in the transformation of tryptophan to nicotinic acid (1, 2). This compound also has nicotinic acid activity for the rat (3, 4, 5) and *Xanthomonas pruni* (6). 3-Hydroxyanthranilic acid is converted almost quantitatively to quinolinic acid by rat liver slices and homogenates, and by extracts of acetone powder of rat liver, but no nicotinic acid is formed under these conditions (7, 8). The participation of an

unknown intermediate in this *in vitro* conversion to quinolinic acid has been shown by spectrophotometric methods (9). Evidence for the existence of this intermediate is the appearance of an absorption maximum at 360 m μ with the simultaneous disappearance of 3-hydroxyanthranilic acid. As the absorption at 360 m μ decreases with time, there is an increase in the amount of quinolinic acid in the incubation mixture. It has been shown that these transformations require oxygen (9, 10).

The present work was undertaken in order to establish the mechanism of quinolinic acid formation from 3-hydroxyanthranilic acid using an enzyme system from rat and beef livers. A study of this enzyme system was made with regard to the enzyme(s) involved, best conditions for the formation of the intermediate, and its subsequent conversion to quinolinic acid.

DISCUSSION OF RESULTS

Further evidence for the participation of an unstable intermediate (Compound I) in the enzymatic oxidation of 3-hydroxyanthranilic acid to quinolinic acid has been presented. Manometric studies using acetone powder extracts of rat and beef liver, indicate that Compound I may have the same oxidation state as quinolinic acid. The requirement for ferrous iron in the formation of Compound I has been demonstrated, but the subsequent conversion to quinolinic acid is not dependent upon this activator.

The conversion of Compound I to quinolinic acid can be spontaneous since theoretical amounts of quinolinic acid are produced as Compound I disappears from aqueous or ethanol solutions after precipitation of the protein with 83 or 92% ethanol. The rate of spontaneous formation of quinolinic acid was the same under nitrogen and air. This gives added support to the idea that Compound I has the same oxidation state as quinolinic acid.

Compound I is converted to a more stable Compound II with strong mineral acids with the release of the N as ammonia. Compound II did not give rise to quinolinic acid under any conditions tested.

Methods of fractionation of the enzyme were investigated. In the initial stages of fractionation activity was completely lost after one or two steps, but the activity could be restored by the addition of 10^{-3} M. cysteine. Continued fractionation resulted in loss of enzyme activity which was not restored by cysteine. The enzyme activity is precipitated between 40 and 70% saturation with ammonium sulfate. It is quite soluble in ethanol or acetone. In the presence of 20% ethanol, the activity is precipitated by zinc chloride at a concentration of .005 M. The enzyme is stable to pH 4.0 at 0°C. for at least an hour. The enzyme is insensitive to cyanide and azide at concentrations which are inhibitory to peroxidase systems. The amide or methyl ester of 3-hydroxyanthranilic is not oxidized by this enzyme system.

Compound II was shown to react with carbonyl reagents, but Compound I does not. The purification of Compound II was accomplished using fluorisil columns, paper chromatography, solka-floc columns,

and activated charcoal. A 2,4-dinitrophenylhydrazine derivative of Compound II was prepared from the alkaline eluates of charcoal.

68 pages. \$1.00. MicA 55-42

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CELL-FREE EXTRACTS OF UNICELLULAR ALGAE. A STUDY OF PREPARATIVE TECHNIQUES AND REACTION COMPONENTS.

(Publication No. 10,534)

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University of Illinois, 1954

According to previous reports, the Hill reaction activity of chloroplast material from unicellular algae is low and short-lived. A modification of the Hughes bacterial press was used to prepare cell-free extracts of such algae, which exhibited a long-lasting, high-rate Hill reaction. The conditions necessary for maximum activity were determined and found similar to those reported for chloroplast fragments from higher plants.

Two stimulants of Hill reaction activity (oxygen evolution in light) of *Chlorella* chloroplast fragments (with ferricyanide as oxidant) were found, both unlike any previously reported stimulant. The first was a protein derived from *Chlorella*, *Anabaena* and *Zea mays*, which caused activation of chloroplast fragments partly deactivated by alkali. This effect was interpreted as the first instance of separation and recombination of proteins necessary for the Hill reaction. This stimulation, while established beyond doubt, could not be repeated at will; some necessary experimental condition apparently remains to be established.

The second stimulant was a substance occurring in yeast extracts. It caused stimulation of Hill reaction in chloroplast fragments of relatively high activity, particularly at high light intensities.

A possible interpretation is that some organic compound in the yeast extract participates in the reaction, and its presence in high concentration allows the enzymatic mechanism to operate at higher rate. Fourteen different known enzymatic cofactors were tested and found incapable of replacing the yeast extract as stimulant.

The data from this and other studies of the Hill reaction were re-evaluated to show that the photochemical properties of whole and fragmented chloroplasts are different. This resolves the apparent contradictions in the reported optimum conditions for the Hill reaction. A tentative explanation of this difference is that the protein structure of the intact chloroplast, necessary for the reduction of low-potential oxidants (such as CO₂, or Fe oxalates) is destroyed (or lost) when the chloroplast is fragmented or damaged.

The observed stimulation of the Hill reaction in chloroplast fragments by *Chlorella* and yeast extracts is consistent with the above suggestion.

87 pages. \$1.09. MicA 55-43

STUDIES OF FRUCTOKINASE IN FRUCTOSE ABSORPTION

(Publication No. 10,557)

Marvin Tunis, Ph.D.
University of Illinois, 1954

Introduction

There is evidence that glucose is absorbed from the intestine by way of a phosphorylation-dephosphorylation cycle occurring in the intestinal mucosa, and that it enters the portal blood as free glucose (1). However, there is conflicting evidence concerning the absorption of fructose. The fate of ingested fructose presents an enigma which deserves further study.

Liver homogenates contain an active enzyme which readily phosphorylates fructose (2), and there are other enzymes present in liver which contribute to fructose metabolism (3). A paradoxical situation appears, however, since evidence has been obtained indicating the conversion of fructose to glucose during its absorption from the intestine (4-6).

Discussion of Results

Since glucose metabolism is impaired in diabetes (7) while fructose metabolism in diabetic subjects apparently is normal (8), an investigation was made using alloxan-diabetic rats. They were found useful in studying the overall response of the blood sugar, as well as the nature of the sugar entering the blood stream, during the intestinal absorption of fructose.

In alloxan-diabetic rats intravenously injected fructose disappears from the blood stream at a rate equal to that found in normal animals; but glucose, similarly administered, is not cleared from the blood

stream. The intravenously injected fructose, after its disappearance, is found to lead to higher blood sugar levels 20-30 minutes after the injections.

Alloxan-diabetic rats, actively absorbing fructose or glucose from the small intestine, show a linear, progressive rise in the total blood sugar which is due to glucose in both cases. There is no lag associated with this increase, which indicates the conversion of fructose to glucose in the intestinal mucosa. Only very slight increases in portal blood fructose were observed.

Extracts of rat intestinal mucosa prepared in phosphate buffer phosphorylated fructose in the presence of ATP and magnesium ions. Ammonium sulfate fractionation gave a 30-50 per cent fraction which contained most of the activity. Flash heating to 65° C. was found to destroy the ability to phosphorylate fructose.

It seemed desirable to attempt to isolate an intermediary product of the phosphorylation reaction taking place in rat intestinal mucosal extracts. To this end, two similar samples from such an experiment were deproteinized, one with trichloroacetic acid, which would permit phosphate esters to remain in solution, and the second with zinc sulfate-barium hydroxide to precipitate phosphate esters. Comparison of the values obtained for remaining fructose indicated that a fructose phosphate was formed. An intermediary product was isolated in larger scale experiments which, on the basis of fructose content and increase in acid-labile phosphorus, appears to be the ester, fructose-1-phosphate.

78 pages. \$1.00. MicA 55-44

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GLUCOSE DEHYDROGENASE

(Publication No. 10,613)

Jerome Paul Van Buren, Ph.D.
Cornell University, 1954

An investigation of animal glucose dehydrogenase was undertaken in order to further clarify the role of

this enzyme in glucose metabolism. This study involved the purification of the enzyme, the determination of some of its properties, and an investigation of its activity in liver homogenate fractions.

By means of fractionations with ammonium sulfate, potassium phosphate, acetone, and calcium phosphate gel it was possible to purify the enzyme from beef liver 250 fold and to obtain a product having a specific activity of 5,000 Strecker units per mg. of protein. There was no direct evidence that such preparations were pure.

The enzyme showed an optimum activity at pH 10 in phosphate and Tris buffers. It was inhibited by compounds related to glucose and the pyridine nucleotides as well as by increasing salt concentrations. The absorption spectrum of the purified material revealed 3 small peaks between 350 and 410 millimicrons.

It was found that glucose dehydrogenase was present in the particulate fraction of rat liver homogenates, while the enzymes oxidizing glucose-6-phosphate and fructose-1,6-diphosphate were located in the soluble fraction. This made possible the study of the activity of glucose dehydrogenase in a complex system without the difficulty of having to take into account the oxidation of glucose by other enzymes. The utilization of glucose by the particulate fraction was found to be stimulated by dinitrophenol and by tricarboxylic acid cycle intermediates. Fluoroacetate did not decrease the effect of α -ketoglutarate, and adenosine triphosphate would not duplicate the effect of this intermediate. A high level of glucose was needed for optimum oxidation. Evidence was obtained indicating a higher concentration of glucose in the particulate fraction than in the soluble fraction of liver cells. These findings are believed consistent with a theory that the oxidation of glucose by the particulate fraction was due to the activity of glucose dehydrogenase. 59 pages. \$1.00. MicA 55-45

CHEMISTRY, INORGANIC

OBSERVATIONS ON THE RARE EARTHS: I. PREPARATION OF ANHYDROUS NITRATES. II. ELECTROCHEMICAL STUDIES IN ANHYDROUS ETHYLENEDIAMINE.

(Publication No. 10,440)

Victor Daniel Aftandilian, Ph.D.
University of Illinois, 1954

Part One

The literature records no general procedure for the preparation of anhydrous rare earth metal nitrates. All attempts at dehydration of hydrated nitrates have yielded basic products.

Reaction of liquid dinitrogen(IV) oxide with metal carbonates or oxides to yield anhydrous nitrates was

probably first noted by Oswald (1), who obtained sodium nitrate in this fashion. Subsequent studies (2,3) have shown the method to be a general one, the reaction proceeding most rapidly in closed containers at elevated temperatures and resultant high nitrogen(IV) oxide pressures.

The present study involves an extension of a modification of the technique of Gibson (2,3) to reactions of rare earth metal oxides with liquid dinitrogen(IV) oxide and the resulting quantitative preparation of anhydrous nitrates of lanthanum, praseodymium(III), neodymium, samarium(III), gadolinium, and yttrium in specially built apparatus at 140 C and 80 atm. pressure.

The reaction proceeds according to the following equation:



Although intermediates containing nitrogen(IV) oxide of solvation were formed, these materials were easily and completely desolvated by several hours of vacuum heating at 137 C.

The rare earth metal contents of the anhydrous nitrates were determined by the conventional method of evaporation of aqueous solutions of the nitrates to dryness and subsequent ignition to the oxide. The nitrate contents were determined by a gravimetric procedure using nitron as precipitating agent.

The anhydrous nitrates prepared by this method are voluminous powders, with colors comparable to those of the chlorides. They dissolve rapidly and completely in water, absolute ethanol, and anhydrous ethylenediamine. The absorption bands in absolute ethanol solutions due to rare earth metal ions are identical with those in aqueous solutions.

PART TWO

Current electrolytic procedures used for the preparation of rare earth metals require fused halide baths at temperatures which are so elevated as to cause practical difficulties. Because of the highly electro-positive natures of these metals, it is impossible to deposit them from aqueous solutions. On the other hand, the well-known tendencies for solvents which are much more basic than water to stabilize low and strongly reducing oxidation states suggest the feasibility of electrodeposition of rare earth metals from such media. Such a conclusion is supported by reports of successful deposition, for example, of alkali metals from anhydrous ethylenediamine (4).

Zimmerman (5) studied the solubilities, conductivities, and electrolyses of rare earth metal salts in anhydrous ethylenediamine. Although some cathodic deposits were obtained they could not be characterized due to the extremely small quantities of these deposits. However the results obtained suggested strongly the value of more extensive investigations.

The present work involves a study of solubilities and conductivities of rare earth metal nitrates as a preliminary investigation to the study of electrolysis of rare earth metal nitrates in anhydrous ethylenediamine.

Solubilities of anhydrous lanthanum,

praseodymium(III), neodymium, samarium(III), gadolinium, and yttrium nitrates were determined in anhydrous ethylenediamine. It was found that these nitrates are not very soluble in ethylenediamine and that they do not follow any general trend.

Conductivity studies on solutions of the rare earth nitrates indicate that these salts behave as weak electrolytes in ethylenediamine. The equivalent conductance values of rare earth metal ions decrease from lanthanum to gadolinium. This is probably due to the increase in solvation of these ions with ethylenediamine.

Amorphous elemental lanthanum, praseodymium, samarium, and gadolinium were prepared by electrolysis of their nitrate solutions in ethylenediamine. The amorphous character of these elements was shown by x-ray diffraction studies. Heating the amorphous rare earth elements in vacuum at 1000 C resulted in a certain degree of crystallinity in these elements. This fact was also shown by x-ray diffraction studies. The theta values and "d" spacings for elemental samarium were obtained for the first time.

112 pages. \$1.40. MicA 55-46

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THE PHOTOCHEMICAL REACTIONS OF SOME TRANSITION METAL COMPLEXES

(Publication No. 10,422)

Seward Elmer Beacom, Ph.D.
University of Connecticut, 1954

A survey of the literature has shown that any study of the photochemical properties of coordination compounds has been limited, for the most part, to the trioxalato complexes of iron, cobalt, manganese and chromium. Casual references have been made to some complex compounds which were observed to be unstable toward light. In this study, a systematic examination of approximately 150 complex compounds by the use of a semi-quantitative approach has shown that a limited number of such compounds are sensitive to ultraviolet radiation.

Several coordination compounds have been prepared using the peroxydisulfate ion as the anion. These compounds changed color upon irradiation by ultraviolet or upon irradiation followed by heating. In several instances a reversible color change, that is, phototropy, has been observed. A mechanism has been proposed to account for these color changes with

parts of the experimental data being obtained by use of the mass spectrometer.

The known compound, $[\text{Co}(\text{NH}_3)_6]_2(\text{SO}_4)_2 \cdot \text{S}_2\text{O}_8$, was prepared by several different procedures. This substance was shown to exhibit a phototropic change, both after an original short-time exposure to ultraviolet as well as after prolonged exposure followed by heating.

The two new compounds, $[\text{Co}(\text{en})_3]_2(\text{S}_2\text{O}_8)_3$, and $[\text{Cr}(\text{en})_3]_2(\text{S}_2\text{O}_8)_3 \cdot 2\text{H}_2\text{O}$, were prepared. The cobalt compound exhibited phototropic properties upon exposure to ultraviolet followed by heating. The chromium compound showed only an irreversible color change after irradiation and heating.

A mechanism has been proposed to account for the various color changes observed in these compounds. The assumption is made that nucleation brought about by electronic excitation is the origin of the phenomena.

79 pages. \$1.00. MicA55-47

THE STEREOCHEMISTRY OF COMPLEX INORGANIC COMPOUNDS:

- I. APPLICATION OF THE CHELATE EFFECT TO STEREOCHEMICAL PROBLEMS.
- II. THE RELATIONSHIPS OF INFRARED SPECTRA OF COMPLEX INORGANIC COMPOUNDS TO THEIR STEREOCHEMICAL FEATURES.

(Publication No. 10,457)

Daryle Hadley Busch, Ph.D.
University of Illinois, 1954

In view of the tendency of additional chelate rings to enhance the stability of complex ions (1), the maximum number of chelate rings would normally be expected to form. From this principle, complexes have been designed or chosen for the study of the stereochemistry of hexadentate, tetradentate, pentadentate, and bidentate complexes of ethylenediaminetetraacetic acid (EDTA). An attempt has also been made to add additional chelate rings to coordinately saturated amine complexes, without replacement of the coordinated atoms.

In spite of the vast literature on the complexes of ethylenediaminetetraacetic acid, very little has been proven with regard to the stereochemistry of the complex ions it forms. Schwarzenbach (2) first demonstrated that it might act as pentadentate or hexadentate donor in cobalt(III) complexes. Comparison of the infrared spectra of pentadentate and hexadentate complexes confirms this. Partial resolution of the hexadentate complex was attained by two methods. The pentadentate complexes are not sufficiently stable to allow isomer studies; partial resolution of the complex $[\text{Co}(\text{EDTA})\text{Br}]^-$ was accomplished with d-quartz. Its conversion to the hexadentate species is not accompanied by complete racemization. Platinum(II) and palladium(II) were employed to study complexes containing three or fewer chelate rings. The reaction of K_2PdCl_4 , K_2PtCl_4 , PdCl_2 , or PtCl_2 with $\text{Na}_2\text{H}_2\text{EDTA}$ produces crystalline compounds of the

empirical formula, $H_4M^{II}(EDTA)Cl_2 \cdot 5H_2O$. These compounds were found to contain bidentate EDTA. They were converted to $H_2M^{II}(EDTA)$, in which the EDTA is tetradentate, as shown by the existence of two carbonyl absorption bands of about the same intensity. These tetradentate complexes contain two asymmetric nitrogens, so they may exist as racemic or meso forms. Evidence was obtained for the existence of only the racemic form.

The reactivity of coordinated metal amines toward carbonyl compounds has been demonstrated by early workers (3). These reactions are often attended by formation of additional chelate rings, or the introduction of more powerful donor atoms. An attempt was made to produce a cyclic molecule completely surrounding a complexed metal ion by the reaction of two moles of diacetyl with two moles of coordinated diamine. The reactions produced a variety of results, the most common products apparently being complex polymeric cations. Bis(oxalyldihydrazide)-nickel(II) reacts with diacetyl yielding an unusually stable product having in its composition two moles of biacetyl and two moles of oxalyldihydrazide for each atom of nickel. The cobalt derivative is similar.

Krumholtz (4) showed that the chromophoric group in the biacetylbismethylimine complex of iron(II) is essentially the same as that present in the complexes of iron(II) with o-phenanthroline and dipyridyl. In view of the importance of the group $-N=C-C=N-$ to the work discussed in the preceding section, a study of this chromophoric system was undertaken. The ultraviolet, visible, and infrared spectra were obtained for the compounds (a) tris(o-phenanthroline)-iron(II) chloride, (b) tris(α, α' -dipyridyl)iron(II) perchlorate, (c) tris(pyridinalmethylimine)iron(II) iodide, (d) tris(biacetylbismethylimine)iron(II) iodide, (e) bis(pyridinal)ethylenediimineiron(II) chloride, (f) o-phenanthroline, (g) α, α' -dipyridyl, and (h) bis(pyridinal)ethylenediimine. The visible and ultraviolet spectra of the iron(II) compounds are all quite similar, indicating the presence of a common chromophoric group. Comparison of the infrared spectra of the complex compounds with those of the free ligands indicates that the diamagnetic species ((a), (b), (c), (d)) all involve bonds fundamentally dependent on the participation of the iron(II) atom in a conjugated chelate ring. The anomalous behavior of compound (e) indicates that six equivalent bonds to the iron(II) are necessary to obtain the characteristic diamagnetic type.

The infrared spectra for a series of hexammines, acidopentammines, and diacidotetrammines were obtained and the characteristics of the spectra discussed on the basis of the probable configuration of the coordinated groups, as opposed to interpretations (5) which have been based on the symmetry of the octahedron. The trans-effect as evidenced in these infrared spectra was also discussed. Differences in the infrared spectra of the cis and trans isomers (6) of cobalt ammines are probably a result of relative symmetries rather than the trans-effect.

153 pages. \$1.91. MicA 55-48

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A STUDY OF THE DISTRIBUTION OF TRACE ELEMENTS BETWEEN MOLTEN AND SOLID SALTS USING RADIOACTIVE TRACERS

(Publication No. 10,423)

James Joseph Casey, Ph.D.
University of Connecticut, 1954

A study has been made of the system $BaCl_2$ - $BaZrO_3$ - $CeCl_3$ at $1000^\circ C$. in vacuo. Radiotracer experiments showed that essentially none of the cerium remained in the molten phase when present in amounts ranging from 10^{-13} to 18.7 atom per cent of the cerium-zirconium content of the reaction mixture. These experiments also indicated that up to seven per cent of the barium in barium zirconate was replaced by cerium, although no change in lattice parameter of the barium zirconate was detected by X-ray powder methods.

X-ray examination of the insoluble residues from the experiments showed the presence of solid phases not present in the reactants. Two of these phases were identified as monoclinic and tetragonal zirconia or solid solutions of these with a little cerium(III)-oxide. The third phase was identified as $Ce_2O_3 \cdot 2ZrO_2$. The lines of its X-ray powder pattern can be indexed on the basis of a face-centered cubic cell of lattice parameter 10.699 ± 0.005 Å. Some possible structures for this phase are discussed, and its possible relationship to the pyrochlore structure is noted.

The major reaction occurring in the system was concluded to be the following:



107 pages. \$1.34. MicA 55-49

COMPOUNDS OF HIGH NITROGEN CONTENT DERIVATIVES OF 5-AMINOTETRAZOLE

(Publication No. 10,465)

James William Currier, Ph.D.
University of Illinois, 1954

An improved synthesis of N-(5-tetrazolyl) urethane was developed based upon a Schotten-Baumann

modification of the original synthesis by Stolle which involved the acylation of 5-aminotetrazole with ethyl chlorocarbonate. Attempts to ammonolyze this urethane derivative in aqueous and anhydrous liquid ammonia failed to produce the corresponding amide. Hydrazinolysis of the ester, however, was readily accomplished in boiling 85 per cent hydrazine hydrate. The product, the hydrazine salt of 4-(5-tetrazolyl) semicarbazide, was converted by acidification to the free 4-(5-tetrazolyl) semicarbazide. This substance gives reactions typical of a hydrazide, forming hydrazones with aldehydes and ketones and 1-benzoyl-4-(5-tetrazolyl) semicarbazide on treatment with benzoyl chloride. In addition, this substance like other 5-monosubstituted tetrazoles forms amine and metal salts. The ammonium, hydrazinium, lithium, sodium, potassium, and barium as well as some transition and heavy metal salts of this substance were prepared. Diazotization of the free 4-(5-tetrazolyl) semicarbazide produced the sensitive compound, N-(5-tetrazolyl) carbamyl azide, which due to the extremely reactive azide group readily undergoes solvolysis with nitrogen bases to produce N-(5-tetrazolyl) ureas. Thus ammonolysis of this compound produced the ammonium salt of N-(5-tetrazolyl) urea. By acidification of this salt pure N-(5-tetrazolyl) urea was first produced. Characterization of this urea derivative aided in the development of other methods for the synthesis of this compound.

Pure samples of N-(5-tetrazolyl) urea have also been prepared in small quantity and in good yield by the thermal rearrangement of its isomer, 5-tetrazolylammonium cyanate, in a xylene or di-n-butyl ether suspension. Purification of the crude product was accomplished by washing the solid residue with boiling water. 5-Tetrazolylammonium cyanate was prepared from a relatively concentrated solution of 5-aminotetrazole and cyanic acid according to a procedure used by Thiele and Ingle. This salt was further identified by a comparison of its solvolytic reactions with those of its isomer, N-(5-tetrazolyl) urea.

Impure samples of N-(5-tetrazolyl) urea have also been prepared in rather poor yield from dilute aqueous solutions of 5-aminotetrazole and cyanic acid. This product could not be purified, but the presence of N-(5-tetrazolyl) urea was established by its X-ray diffraction pattern.

Since the above synthesis was not satisfactory, the analogous reaction of 5-hydrazinotetrazole and cyanic acid reported by Thiele and Ingle was repeated. This synthesis gives 1-(5-tetrazolyl) semicarbazide in good yield. The difference in the two syntheses apparently lies in the difference between the basicity of the 5-hydrazino and 5-aminotetrazoles.

For the purpose of comparing their properties with those of N-(5-tetrazolyl) urea and compounds of related structure, N-ethyl, N,N-dimethyl, and N,N-diethyl-N'-(5-tetrazolyl) ureas were prepared by the respective reactions of 5-aminotetrazole with ethyl cyanate, N,N-dimethyl carbamyl chloride, and N,N-diethyl carbamyl chloride.

In addition to these carbonic acid derivatives, the synthesis of 1-octadecyl-5-octadecylaminotetrazole

was accomplished by the following steps: N,N'-Diocadecyl-S-methyl-thiuronium hydrochloride was hydrazinolized effecting the replacement of the S-methyl group with a hydrazide group to form N-amino-N',N''-diocadecyl guanidine. The subsequent diazotization of this product in glacial acetic acid produced 1-octadecyl-5-octadecylaminotetrazole.

109 pages. \$1.36. MicA 55-50

DERIVATIVES OF HYDRAZINE: I. PREPARATION OF N-SUBSTITUTED HYDRAZINES.

II. CHEMISTRY OF TRIAMINO GUANIDINE.

(Publication No. 10,466)

Louis Harold Diamond, Ph.D.
University of Illinois, 1954

PART I

Chloramine, produced by the reaction of equimolar quantities of hypochlorite and ammonia in alkaline solution, is capable of reacting with further quantities of ammonia at elevated temperatures to produce hydrazine. It has been postulated that this reaction involves the formation of the NHCl^- ion and the transient existence of the imide molecule, NH , as the active intermediate. The particular reaction leading to the formation of hydrazine from chloramine could involve the imide molecule as an electron deficient structure. On the basis of this mechanism, it was to be hoped that the reaction with other Lewis bases such as water and amines would lead to the formation of hydroxylamine and N-substituted hydrazines, respectively.

It has been found that chloramine does in fact react with various alkylamines to produce the corresponding N-substituted hydrazines. Conditions leading to the formation of alkylhydrazines are similar to those which apply to the Raschig synthesis of hydrazine. The yield of N-substituted hydrazine has been found to depend upon a) the mole ratio of amine to chloramine, b) addition of a metal deactivator such as gelatin, c) the presence of permanent base in the form of sodium hydroxide, and d) the temperature at which the reaction is carried out. Significant differences, however, were also observed in that a) the molar ratio of amine to chloramine necessary for maximum yields is much smaller than the ammonia-chloramine ratio required to obtain maximum yields of hydrazine, and b) the temperature required for the formation of alkylhydrazines is considerably lower than that necessary for the formation of hydrazine. Yields of methylhydrazine in excess of 60 per cent were obtained with a 5:1 molar ratio of methylamine to chloramine in the presence of small amounts of gelatine.

Methylhydrazine was isolated and analyzed as methylhydrazine sulfate. The reaction between chloramine and alkylamines was extended to the preparation of a series of alkylhydrazines from ethylhydrazine to hexylhydrazine. It was also found that

β -hydroxyethylhydrazine and β -aminoethylhydrazine may be prepared from chloramine and the corresponding amines.

The iodate titration in strongly acid solution was found to be applicable for the determination of the hydrazino nitrogen content in alkylhydrazines.

Investigations of the rate of reaction of alkylamines with chloramine indicate that the speed of the reaction is determined by the relative base strengths of the amines involved.

PART II

Although triaminoguanidine is not presently a commercial chemical, it has several potentially interesting applications. It is a compound of high nitrogen content and has been referred to as "packaged hydrazine." The picrate, nitrate, and perchlorate salts approach oxygen balance and may therefore be expected to be explosive.

It has been found that triaminoguanidine hydrochloride and triaminoguanidine nitrate may be prepared in good yield from the respective reactions of guanidine hydrochloride and guanidine nitrate with a 75 per cent excess of hydrazine. Use of absolute ethanol as a solvent for the reaction has been shown to result in an increased yield.

The physical properties of triaminoguanidine hydrochloride and triaminoguanidine nitrate have been determined. It has been found that both substances are relatively stable compounds, and no difficulties should be encountered in handling or storing the materials. 140 pages. \$1.75. MicA 55-51

SOME ELECTROCHEMICAL STUDIES OF CHLORAMINE AND HYDRAZINE

(Publication No. 10,485)

Robert Nelson Hammer, Ph.D.
University of Illinois, 1954

Although it has been claimed that hydrazine can be obtained by the anodic oxidation of potassium amide in liquid ammonia, electrolysis of such a solution gives only pure nitrogen at the anode.

In order to support the claim that hydrazine cannot be obtained by liquid ammonia electrolysis, as well as to study some of the properties of chloramine in this medium, a technique was developed for the determination of current-voltage curves at a rotating platinum microelectrode. The reference electrode used in this work consisted of a large platinum foil dipping into a solution of sodium metal in liquid ammonia.

Current-voltage curves of basic and neutral solutions in liquid ammonia show a region of about three volts over which there is virtually complete polarization of the microelectrode. This region extends from about +3.0 volts, at which nitrogen evolution occurs, to about 0.0 volt, at which electron dissolution begins. In acidic solutions, however, the

range is restricted by the discharge of the ammonium ion at a half-wave potential of about 1.0 volt versus the electron electrode.

Hydrazine was found to be electrochemically inert at the platinum microelectrode. Chloramine, on the other hand, gives a well-defined reduction wave at a half-wave potential of about +1.7 volts versus the electron electrode. At -78°C the chloramine diffusion current changes very little over a period of twenty-four hours, indicating that under these conditions the solution is quite stable. At -35°C , however, the wave height decreases at a measurable rate. If hydrazine is added to the solution, it reacts with chloramine so rapidly at -78°C that the latter is completely consumed in an hour or less.

In aqueous solution, chloramine was found to be reducible at the dropping mercury electrode. Its polarographic behavior was studied in basic solutions varying from a buffer of pH 8.85 to 0.8 N KOH. The diffusion current-concentration plot was linear over a concentration range from 0.1 to about 40 millimolar, and the relationship was found to be independent of pH. The half-wave potential is in the range -0.35 to -0.40 volt versus the saturated calomel electrode.

Alkaline solutions of chloramine are unstable and decompose to give nitrogen as the gaseous decomposition product. The rate of decomposition of chloramine in an 0.8 N KOH solution at 25°C was followed by measuring the diffusion current at constant potential over a period of 10 hours. A plot of $\log i_d$ versus time showed the decomposition to be first order, with k equal to 0.0088 min^{-1} . At higher chloramine concentrations, the plot showed a slight curvature in a direction indicating that initially the rate is slower than during the remainder of the decomposition.

96 pages. \$1.20. MicA 55-52

EXCHANGE REACTIONS OF THE TRANSURANIUM ELEMENTS. SECTION I. Am(III)-Am(V)-Am(VI), Am(III)-Am(V), AND Am(V)-Am(VI)

(Publication No. 9727)

Thomas Kent Keenan, Ph.D.
University of New Mexico, 1954

HALF-LIFE OF Am^{242m} .

The half-life of Am^{242m} has been redetermined to a precision 10 times that previously known, yielding a value of 16.01 ± 0.02 hours.

THE EFFECT OF COUNTING INTERVAL ON THE PROBLEM OF COUNTING SHORT-LIVED ACTIVITIES.

A mathematical treatment of radioactive decay laws shows the following relations:

$$\text{A. } \frac{\text{average counting rate}}{\text{actual counting rate}} = 1 + \frac{(\lambda \Delta t)^2}{24} + \frac{(\lambda \Delta t)^4}{1920} + \dots$$

(at $\Delta t/2$)

Utilization of this equation leads to the very useful rule of thumb: "ONE MAY COUNT A DECAYING SAMPLE FOR 20%, (i.e., 1/5th) OF A HALF-LIFE; ASSIGN THE EXPERIMENTALLY DETERMINED AVERAGE COUNTING RATE TO THE MIDPOINT OF THIS COUNTING PERIOD AND STILL BE ACCURATE TO < 0.1%."

B. Letting ϕ be the fraction of an experimental counting interval at which average counting rate is equal to actual disintegration rate, ϕ is:

$$\phi = 1/2 \frac{\lambda \Delta t + (\lambda \Delta t)^3}{24 \quad 2880}$$

C. A new relationship between the specific decay constant, λ , and the total number of counts collected in two identical counting periods has been determined. These counting periods may be of any length in order that large and statistically valid numbers of counts be collected. This relationship is:

$$\lambda = \frac{\ln(\delta N_1 / \delta N_2)}{t_2}$$

where δN_1 and δN_2 are the total numbers of counts collected, and t_2 is the time elapsed between the beginning of the first and the beginning of the second counting interval.

NON-EXCHANGE BETWEEN Am(III) AND Am(V) IN ACID CONCENTRATIONS LESS THAN 2.00 FORMAL.

Exchange studies in all common media and with temperatures as high as 80°C have indicated very slow exchange between the species Am^{+++} and AmO_2^+ at acidities less than 2.00 f.

At acidities less than 2.00 f, the exchange half-time is of the order of 500-2000 hours at americium concentrations up to ca. 0.02 f each Am(III) and Am(V). The large uncertainty results from the fact that it was impossible to follow the exchange over more than 10% of a half-life. This limitation was due to the self-reduction of Am(V) and the moderately short (16.01 hr.) half-life of the tracer.

EXCHANGE BETWEEN Am(III) AND Am(V) IN ACID CONCENTRATIONS GREATER THAN 2.00 FORMAL.

At concentrations of ca. $\text{Am(III)} = 0.1$ f, $\text{Am(V)} = 0.1$ f and $\text{Am(VI)} = 0.1$ f, the half-time of exchange is of the order of 15-30 hours in acidities greater than 2.00 f.

The state AmO_2^+ undergoes disproportionation with a 4th order hydrogen-ion dependence. Therefore, the disappearance of AmO_2^+ via this disproportionation becomes rapid at acidities of ≥ 2.00 f. The products of this disproportionation are Am(VI) and the yet unobserved species Am(IV).

It was presumed at first that the fleeting presence of Am(IV) would open a kinetic path for exchange. However, it has been shown that Am(IV) cannot have a finite existence although exchange is still observed in high-acid media. Therefore, some undetermined kinetic path is available to the Am(III) and Am(V) ions which must be directly dependent upon hydrogen-ion concentration.

It is difficult to elucidate the rate law and mechanism in such media, for the concentrations of the higher valence states of americium are changing very rapidly due to the 4th order hydrogen-ion dependence of the disproportionation reaction.

An increase in the concentration of the reacting species with a hope to increase the rate of exchange will result also in a more rapid change in the concentrations of the higher valence states.

EXCHANGE BETWEEN Am(V) AND Am(VI).

At concentrations of 0.001 f AmO_2^+ , 0.001 f AmO_2^{++} , 1.00 f HClO_4 and at 0°C, the exchange between the species Am(V) and Am(VI) was complete within 60 seconds. 53 pages. \$1.00. MicA 55-53

A STUDY OF THE ELECTROREDUCTION AND ADSORPTION OF N,N-DIMETHYL-p-PHENYLAZOANILINE AT A MERCURY SURFACE

(Publication No. 10,497)

Theodore Joseph Kneip, Ph.D.
University of Illinois, 1954

A study has been made of the electroreduction of N,N-dimethyl-p-phenylazoaniline at a mercury electrode. The adsorption of the compound has been investigated by means of radioactive tracer techniques.

In basic media, polarographic studies show the reaction to be a two electron reduction to the hydrazo compound. A coulometric determination of the number of electrons consumed per molecule, confirmed the value of two at pH 13.5. The primary product of the reduction is believed to disproportionate to give the original dye together with aniline and p-(N,N-dimethylamino)aniline. The disproportionation is slow enough at pH 13.5 to allow the observation of an anodic wave in polarograms obtained from electrolyzed solutions. At pH 9.50 the rate is too rapid to allow such an observation and the number of electrons consumed per molecule appears to be four in coulometric experiments. Polarographic conditions at pH 9.50 show a reduction much closer to the two electron reduction found at pH 13.5. The disagreement is believed due to the buildup of primary product concentration in the macroelectrolysis, which does not occur in the polarographic experiments.

In acid solution the reduction is a four electron reduction to the amine products under both sets of conditions. There is a possibility that the electrode reaction remains a two electron reduction and the subsequent disproportionation occurs at such a high rate that the reduction proceeds to an overall four electron result.

A second wave is observed in the polarographic experiments at pH values below pH 8. As the pH decreases the wave height increases, until it reaches a value approximately four times that of the first wave. This wave has been shown to be a catalytic hydrogen reduction. The current is kinetically

controlled and somewhat dependent on the buffer materials and buffer concentrations used. Its height has been found to be sensitive to the presence of gelatin. Sufficient amounts of either gelatin or methylcellulose will eliminate this second wave. Adsorption of the dye or its reduction products may be a factor in the production of the catalytic wave.

The reduction of the azo bond has been shown to be a diffusion controlled process at pH values 1.90, 4.42, and 9.50 by means of variation of the current with both the head of the mercury column and the temperature.

The diffusion coefficient of the cationic form of the dye has been calculated from the Ilkovic equation and found to be $3.55 \times 10^{-6} \text{ cm}^2/\text{sec}$ at pH values of 1.90 and 2.89. The value found for the uncharged molecule at pH 13.5 is $3.38 \times 10^{-6} \text{ cm}^2/\text{sec}$.

The dye was labeled in the methyl groups with carbon-14 and the adsorption of the dye on both platinum and mercury surfaces studied. A solid counting technique was used to determine the amount of dye present after immersion in a solution containing the radioactive material, followed by various rinsing techniques.

Evidence of a reversible adsorption was found, but the limitations of the technique prevent quantitative studies of the phenomenon.

60 pages. \$1.00. MicA 55-54

ELECTROCHEMISTRY IN FUSED SALT MEDIA

(Publication No. 10,529)

Robert Allen Osteryoung, Ph.D.
University of Illinois, 1954

A eutectic mixture of potassium and lithium chloride, melting at 352°C has been used as a solvent system. For polarographic purposes, the use of platinum foil as a polarographic reference electrode seems satisfactory. When used as a polarographic anode, the platinum foil reaction involves dissolution to form platinum (II), probably existing in the melt as a chloro-complex, such as tetra-chloroplatinate(II). An attempt was made to establish a lithium-lithium glass reference, analogous to the sodium-sodium glass electrodes previously reported. Owing to the extremely corrosive nature of the metallic lithium, the attempt did not succeed.

Several methods to remove water from the fused melt were tried. Electrolytic methods and chemical methods, such as the addition of titanium tetrachloride or silicon tetrachloride, showed signs of some beneficial action but needs further study. Vacuum drying does remove water from the melts, as indicated by the increased region of low residual current on a polarographic curve. The region of low current is increased from a span of one volt to two volts, or slightly more, in a melt from which the water has been removed.

Polarographic curves for the reduction of the ions of cadmium, cobalt, nickel and tetrachloroplatinate(II)

are presented. Plots of E vs. $\log(i_d - i)$ for nickel and tetrachloroplatinate (II) yield theoretical slopes under certain conditions. The use of a glass diaphragm to separate anode and cathode compartments in fused salt polarography appeared feasible.

Impedance measurements have been made in the fused melt using solid platinum microelectrodes. The results of these measurements indicate that the deposition of nickel, cobalt and platinum, from tetrachloroplatinate (II), is reversible. A theoretical treatment of the behavior of the capacitive and resistive components of the electrical impedance due to the electrode reaction is presented and the experimental evidence appears to be in accord with the theory.

103 pages. \$1.29. MicA 55-55

I. AMPEROMETRIC TITRATION OF CALCIUM WITH THE DISODIUM SALT OF ETHYLENEDIAMINETETRAACETIC ACID. II. A STUDY OF THE ADSORPTION AND ELECTROREDUCTION OF FUMARIC AND MALEIC ACIDS ON METAL SURFACES.

(Publication No. 10,552)

Robert Frederick Sympson, Ph.D.
University of Illinois, 1954

PART I

An amperometric titration for the determination of calcium was developed using the disodium salt of ethylenediaminetetraacetic acid (sodium dihydrogen Versenate) as the titrating reagent. By using zincate ion in potassium hydroxide as an indicator ion, the decrease in diffusion current of zincate after completion of the reaction of calcium with Versenate was used to indicate the calcium end point. This titration is an example of the use of competitive complex formation to permit the reaction of calcium with Versenate in the presence of zinc, which normally forms a more stable complex with Versenate than does calcium. The proposed method yielded results with a standard deviation of 5.9 parts per thousand when titrating 3 to 11 mg. of calcium in an initial volume of 50 ml. Magnesium in moderate amounts did not interfere. With samples of 2 mg. of calcium or less (initial concentration below 0.001 M) the results were low. The proposed method compares favorably in accuracy with other volumetric methods. It is more accurate but less sensitive than optical methods.

PART II

The adsorption of fumaric acid and maleic acid on metal surfaces was studied by using solutions prepared from radioactive carbon-14 labeled fumaric and maleic acids. Fumaric acid was found to be strongly and irreversibly adsorbed on mercury. Maleic acid did not adsorb strongly on either mercury or platinum. The amount of adsorption of fumaric acid on mercury increased with increasing concentration of fumaric acid in solution between 0.190 and 2.86 millimolar. Electrocapillary curves gave no indication of

adsorption of fumaric acid on a dropping mercury electrode. Polarographic reduction curves of fumaric acid also gave no indication of any adsorption controlled reduction process. Further experiments using carbon-14 labeled fumaric acid solutions showed that the amount of adsorption which occurred in 5 seconds, a reasonable drop time for a dropping mercury electrode, was much less than when the mercury surface was in contact with the fumaric acid solution for five minutes. The fact that the electrocapillary curves and polarographic curves gave no evidence of adsorption on a dropping mercury electrode was attributed to the relative slowness of the adsorption. 104 pages. \$1.30. MicA 55-56

malonate were not successful. A product which appeared to be tetraethylpiperazinium dichloride was isolated from the latter.

The effects of substituent groups on the rate of hydrolysis of the β -diethylaminoethyl esters was essentially those expected from the available knowledge of the rates of hydrolysis of ethyl benzoates. It was shown that β -diethylaminoethyl esters hydrolyze about three times as fast as the corresponding ethyl esters. This might not have been predicted from steric considerations.

In general, the rates of alkaline hydrolysis of the β -diethylaminoethyl benzoates studied in this work seem to agree with pharmacological data which have been obtained on the compounds.

91 pages. \$1.14. MicA 55-57

CHEMISTRY, ORGANIC

THE RATES OF ALKALINE HYDROLYSIS OF SOME β -DIETHYLAMINOETHYL ESTERS RELATED TO PROCAINE

(Publication No. 10,098)

Maurice Ray Armstrong, Ph.D.
University of Missouri, 1954

Supervisor: Norman Rabjohn

A number of β -diethylaminoethyl esters of substituted benzoic acids have been prepared, and their rates of alkaline hydrolysis determined by a standard method. These esters are related to procaine and a number are known to possess local anesthetic properties.

The rates of alkaline hydrolysis of the β -diethylaminoethyl esters of the following acids were determined: benzoic 2-methylbenzoic, 3-methylbenzoic, 4-methylbenzoic, 4-aminobenzoic, 2-methyl-4-aminobenzoic, 2-chloro-4-aminobenzoic, 2-methyl-4-nitrobenzoic, 2,6-dichloro-4-nitrobenzoic, 2,4,6-trinitrobenzoic, 2,6-dimethylbenzoic, 2,4,6-trimethylbenzoic, 2,3,5,6-tetramethylbenzoic, and 4-(*n*-propylcarbamino)benzoic acid. In addition to these, studies were made on ethyl benzoate and ethyl mesitoate to obtain comparisons of the rates of ethyl and β -diethylaminoethyl esters.

These esters were obtained from the properly substituted benzoic acids and β -diethylaminoethyl chloride by means of the Horenstein-Pählike procedure. In general, the necessary acids were synthesized by conventional methods. Attempts to prepare the β -diethylaminoethyl ester of 2,4,6-triaminobenzoic acid were fruitless.

Since β -diethylaminoethyl chloride was found to react readily with hindered acids as readily as with the unhindered ones, two reactions were tried to check the scope of this type of condensation. The attempts to cause *n*-butyl chloride to react with 3,5-dinitrobenzoic acid in the presence of pyridine, and β -diethylaminoethyl chloride to condense with diethyl

ALKYLATIONS WITH QUATERNARY SALTS OF 2-AMINOMETHYLINDOLES

(Publication No. 10,461)

Paul LaVerne Cook, Ph.D.
University of Illinois, 1954

Interest in the synthesis of compounds having structural similarity to tryptophan has been stimulated by the fact that several of these compounds have shown biological activity. The recent synthesis of "Isotryptophan," α -amino- β -(2-indole)-propionic acid, and its reported bacteriological activity suggested the possibility that isomers of tryptophan with the alanine side chain in the two position of the indole nucleus might also have antiviral activity. The synthesis of isotryptophan and its methyl analog, α -amino- β -(6-methyl-2-indole)-propionic acid was therefore undertaken. A second goal was the improvement of the known synthetic route to compounds of this type.

Isotryptophan was synthesized via the following series of compounds: chloroacet-*o*-toluidide, dimethylaminoacet-*o*-toluidide, 2-dimethylamino-methylindole, 2-dimethylaminomethylindole methiodide, ethyl α -acetamido- β -(2-indole)-propionate.

The methyl analog, α -amino- β -(6-methyl-2-indole)-propionic acid was prepared via the following intermediates: 6-methylindole-2-carboxylic acid, 6-methylindole-2-carboxylic acid dimethylamide, 2-dimethylaminomethyl-6-methylindole, 2-dimethylaminomethyl-6-methylindole methiodide, ethyl α -acetamido- β -(6-methyl-2-indole)-propionate.

The unique reaction in each of these syntheses was the alkylation of acetamidomalonic ester with the quaternary salt of the 2-aminomethylindole. The product of the reaction was not the anticipated substituted malonic ester, but a substituted propionic ester. Two proposals are offered to account for the formation of a propionic ester rather than a malonic ester.

The first is that ethanolysis of the initially formed malonic ester had occurred. The second suggests the formation of an intermediate cyclic lactam which could undergo cleavage in basic ethanolic solution to

give the observed substituted propionic ester. Both experimental and theoretical evidence are cited in support of the ethanolysis mechanism.

The methiodides of 2-aminomethylindoles are shown to be capable of undergoing amine exchange with piperidine, although the unquaternized bases do not react. 58 pages. \$1.00. MicA 55-58

THE CONJUGATE ADDITION OF
t-BUTYLMAGNESIUM CHLORIDE TO
o-HYDROXY DIARYL KETONES

(Publication No. 10,470)

Fabian Tien-Hwa Fang, Ph.D.
University of Illinois, 1954

Four typical o-hydroxy diaryl ketones were found to condense with t-butylmagnesium chloride to give 2-hydroxy-4-t-butyl-3,4-dihydro compounds. The structures of two adducts were established and the existence of the enolic ketone chelate system was clearly manifested by the infrared absorption spectra in all cases. That the presence of a highly hindered carbonyl function greatly favors such conjugate additions was demonstrated.

2-Hydroxy-1-naphthyl mesityl ketone reacted with the t-butyl Grignard reagent to produce 2-hydroxy-4-t-butyl-3,4-dihydro-1-naphthyl mesityl ketone in yields as high as 91%. The formation of phthalic and mesitoic acids when the dihydro adduct was oxidized with alkaline permanganate indicated that the t-butyl radical had entered the already substituted ring of the naphthalene nucleus.

The less hindered 2-hydroxy-1-naphthyl phenyl ketone yielded under forcing conditions 17% of 2-hydroxy-4-t-butyl-3,4-dihydro-1-naphthyl phenyl ketone as well as 15% of the ketonic tautomer, 2-keto-4-t-butyl-1-tetralyl phenyl ketone.

Duryl 2-hydroxyphenyl ketone was found to give an 82% yield of duryl 2-hydroxy-4-t-butyl-3,4-dihydrophenyl ketone which, by dehydrogenation, acetylation and the action of t-butylmagnesium chloride, in that order, was transformed into the known compound, 2,4-di-t-butylphenyl duryl ketone.

Also under forcing conditions the unhindered 2-hydrobenzophenone reacted with the t-butyl reagent to give among other products 28% of 2-hydroxy-4-t-butyl-3,4-dihydrophenyl phenyl ketone.

The reaction conditions in general involved treatment of the phenolic ketone with approximately five moles of the Grignard reagent and refluxing in a ether-benzene mixture for about one hour, whereas the forcing conditions employed refluxing for forty-eight hours or longer.

The inconvertibility of most of the enolic adducts to their ketonic tautomers and their relative inertness under etherification conditions were observed. For their formation were depicted mechanisms representative of reactions between Grignard reagents and vinylogs of carboxylic acids. Nucleophilic attack of an alkyl carbanion on the resonance-stabilized

enolate salt of the hydroxy ketone was followed by a molecular rearrangement during hydrolysis in favor of the final chelate system.

64 pages. \$1.00. MicA 55-59

POLYMERIZATION AND COPOLYMERIZATION
OF ETHYLENIC KETONES

(Publication No. 10,477)

Arjeh Baruch Galun, Ph.D.
University of Illinois, 1954

INTRODUCTION

A Fiat report (1) mentioned the copolymerization of butadiene and benzalacetone by German workers investigating new synthetic rubbers. Since then many ethylenic ketones have been copolymerized in this laboratory (2, 3, 4), showing that α,β -unsaturated ketones not containing a terminal double bond can undergo heteropolymerization.

The purpose of the work reported in this thesis was to extend this discovery to conjugated diketones and to compare *cis*- and *trans*-isomers with respect to polymerization. The work was specifically directed towards the goals:

- I. To determine which conjugated dicarbonyl compounds would copolymerize.
- II. To determine what monomers would form heteropolymers with these compounds.
- III. To determine the actual amounts of these compounds incorporated in the heteropolymers formed.

DISCUSSION OF RESULTS

A new class of olefinic ketones has been found to copolymerize with styrene and 1,3-dienes. This class consists of conjugated diketones.

trans-Dibenzoyl ethylene was copolymerized with butadiene, 2,3-dimethylbutadiene, isoprene and styrene. All copolymerizations were carried out in emulsion using a persulfate initiator. It was found to be of advantage to use low temperature recipes for the copolymerizations with diene monomers, to avoid interference of the Diels Alder reaction.

trans-Dibenzoyl ethylene retards the polymerization of styrene, but it is incorporated in the copolymer after an induction period. It inhibits the polymerization of vinyl acetate and acrylonitrile which could not be polymerized in its presence. This fact may be explained in terms of the high stability of the free dibenzoyl ethylene radical.

cis-Dibenzoyl ethylene was copolymerized with styrene. The incorporation was only about one percent in all charge ratios (20-60% of the ketone) but the viscosities of these copolymers were twice as high as the viscosity of polystyrene prepared under the same conditions. *cis*-Dibenzoyl ethylene did not inhibit the polymerization of either butadiene or acrylonitrile and no incorporation of the diketone into the polymer could be proved in either case.

trans-Methyl- β -benzoyl acrylate was copolymerized with butadiene and with styrene. It inhibited the polymerization of acrylonitrile. The copolymer with styrene was a tough, elastic solid which did not resemble polystyrene. Some retardation was observed in this copolymerization.

The percent incorporation of the ketonic monomer in all copolymers was determined using ultraviolet and infrared absorption methods with model compounds as the standards. For this purpose 1-methyl-4,5-dibenzoylcyclohexene and 4-carbomethoxy-5-benzoylcyclohexene were prepared as reference materials.

By refluxing a benzene solution of trans-dibenzoyl ethylene with a peroxide catalyst or by exposing the compound to sunlight for a prolonged period, a substance was obtained, which may be a low molecular weight polydibenzoyl ethylene.

In an attempted copolymerization of styrene with parabenzquinone a dark high molecular weight substance was isolated in about ten percent yield which may have been a copolymer of the reactants.

The relative tendency of these ethylenic diketones to polymerize has been correlated with their expected free radical reactivities and with Lewis and Mayo's theory (5) on resonance stabilization of the activated complex.

116 pages. \$1.45. MicA 55-60

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THE CONJUGATE ADDITION OF t-BUTYLMAGNESIUM CHLORIDE TO CINNAMALDEHYDE AND α,β,β -TRIPHENYLACRYLOPHENONE

(Publication No. 10,499)

Lewis Irvin Krimen, Ph.D.
University of Illinois, 1954

The reaction of t-butylmagnesium chloride with cinnamaldehyde has been found to proceed in the conjugate or 1,4 manner. The only aldehyde previously known to react in this way is crotonaldehyde.¹ The product, β -t-butylhydrocinnamaldehyde, was identified by oxidation to the corresponding acid.² The acid, β -t-butylhydrocinnamic acid, has been synthesized from ethyl cinnamate by use of the t-butyl Grignard reagent. This condensation, which had been shown by others to fail under ordinary

conditions,^{3,4} was achieved by operating at low temperatures.

The action of the t-butyl reagent with α,β,β -triphenylacrylophenone, previously shown to react with phenylmagnesium bromide in the conjugate fashion to give the ortho-phenylated product,⁵ has been found to bring about para alkylation and simultaneous hydrogenation of the lateral double bond, the product being p-(t-butyl)- α,β,β -triphenylpropionophenone. The unhydrogenated compound, p-(t-butyl)- α,β,β -triphenylacrylophenone, can be obtained, however, by exposing the reaction mixture to oxygen previous to decomposition.

Dehydrogenation of the saturated ketone has been accomplished, surprisingly, by treatment with a mixture of sodium acetate and acetic anhydride.

The structure of the butylated acrylophenone has been established by an independent synthesis.

62 pages. \$1.00. MicA 55-61

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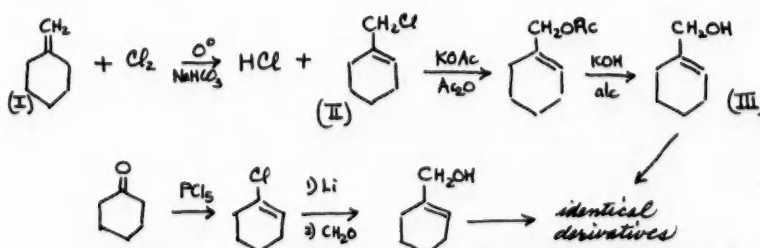
STUDIES IN ALLYLIC SYSTEMS: 1-(CHLOROMETHYL)-CYCLOHEXENE, ITS PREPARATION AND REACTIONS

(Publication No. 9850)

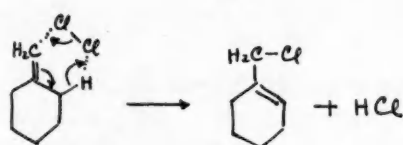
William Wei Lee, Ph.D.
University of Minnesota, 1952

Major Adviser: Stuart W. Fenton

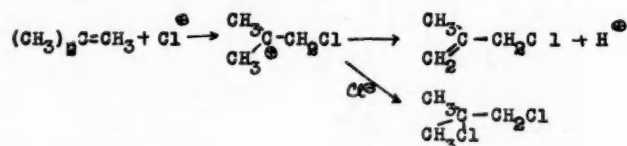
The low temperature chlorination of isobutylenes, in particular, of methylenecyclohexane, (I), has been studied as a means of preparing one pure allylic isomer, in this case, 1-(chloromethyl)-cyclohexene, (II). The structure of this compound was established by its infra-red spectrum and conversion to 1-cyclohexenylcarbinol, (III). This alcohol was independently synthesized by an unambiguous route:



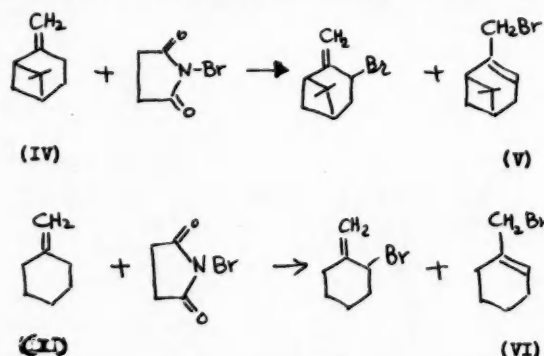
It is believed that the substitutive chlorination of isobutylenes involves a one-step process requiring a transient cyclic intermediate as shown. While this work was in progress, the substitutive chlorination



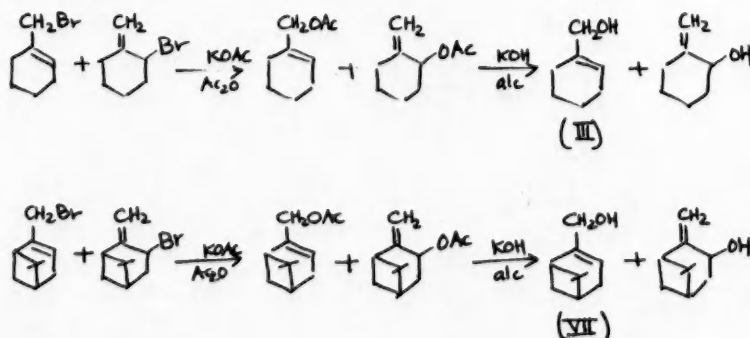
of several terpenes was reported by D. Tishchenko and B. Matveev.¹ Their results are in complete accord with the one-step mechanism requiring a transient ring intermediate and refute the more conventional two-step mechanism involving a carbonium ion intermediate as shown below:



During the course of the above study with methylenecyclohexane, it became of interest to examine its behavior toward bromination with N-bromosuccinimide. This reaction is known to give allylic bromides. Besides methylenecyclohexane, another isobutylene type olefin, β -pinene, (IV), was examined. The results with both methylenecyclohexane and β -pinene indicate that in each case two allylic bromides are formed, with the primary isomer, (VI) and (V) respectively, being present in appreciable quantities:

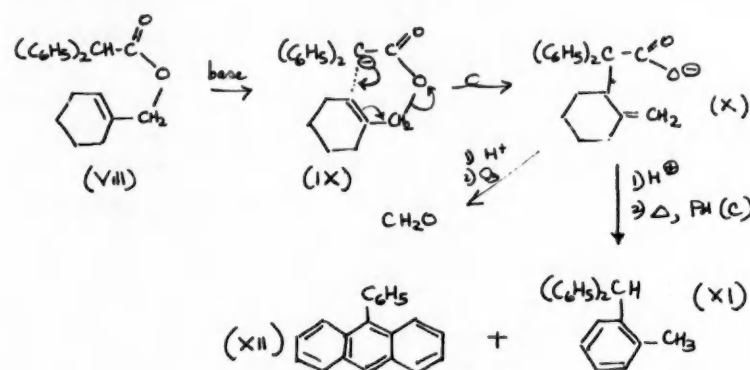


The presence of the primary allylic bromides in the mixtures formed from methylenecyclohexane and β -pinene was demonstrated by conversion the corresponding alcohols, 1-cyclohexenylcarbinol, (III), and 1-myrtanol, (VII), respectively, which were identified by physical properties and properties of their derivatives.



The base catalyzed rearrangement of 1-cyclohexenylmethyl diphenylacetate, (VIII), has been found to yield only one product, the acid from anion (X). The structure of this acid was assigned on the basis of (1) its infra-red spectrum, (2) the fact that it gave formaldehyde upon ozonolysis, and (3) the fact that it

gave o-tolyldiphenylmethane, (XI), and 9-phenylanthracene, (XII), upon decarboxylation and dehydrogenation:



The results support the previously suggested intramolecular mechanism which requires a transient ring intermediate, (IX). Anion (IX) rearranges to the thermodynamically more stable alkyl diphenylacetate ion (X). This mechanism requires, and the results show, that during the rearrangement the double bond is shifted from the ring position in (IX) to the thermodynamically less stable exocyclic position in (X). Evidently the positive free energy change involved in this double bond shift is more than balanced by the negative free energy change for the other structural changes in the rearrangement.

139 pages. \$1.74. MicA 55-62

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I. AROMATIZATION STUDIES ON SIX- AND SEVEN-MEMBERED HETEROCYCLIC RINGS. II. UNSATURATED AMINES: DIAGNOSIS OF DOUBLE BOND POSITION BY ULTRAVIOLET ABSORPTION SPECTRA.

(Publication No. 10,508)

David Millard Locke, Ph.D.
University of Illinois, 1954

Part I.

The efficacy of the aromatization reaction in converting 2,6-dibenzylidenecyclohexanone to the isomeric 2,6-dibenzylphenol (1) and 3,7-dibenzylidene-1,2-cycloheptanedione to 3,7-dibenzyltropone (2) has suggested that this reaction might be of equal value in the analogous heterocyclic systems.

Thus, in order to investigate the possibility of their aromatization, a series of substituted N-methyl-3,5-dibenzylidene-4-piperidones was prepared by condensation of N-methyl-4-piperidone with the following aldehydes: benzaldehyde, p-methylbenzaldehyde, o-methylbenzaldehyde, p-nitrobenzaldehyde, m-nitrobenzaldehyde, p-chlorobenzaldehyde, o-chlorobenzaldehyde, p-methoxybenzaldehyde, p-isopropylbenzaldehyde, p-dimethylaminobenzaldehyde, and p-phenylbenzaldehyde. It was, indeed, found possible to convert these dibenzylidenepiperidones to

their aromatic isomers by treatment with palladium on carbon, thus extending the range of this type of aromatization reaction to heterocyclic compounds. The use of ethylene glycol as solvent for this reaction was introduced; this provides a useful new medium for effecting aromatizations. By this method the following dibenzylpyridones were obtained: N-methyl-3,5-dibenzyl-4-pyridone, N-methyl-3,5-di-(p-methylbenzyl)-4-pyridone, N-methyl-3,5-di-(m-nitrobenzyl)-4-pyridone, N-methyl-3,5-di-(p-methoxybenzyl)-4-pyridone, N-methyl-3,5-di-(p-isopropylbenzyl)-4-pyridone, N-methyl-3,5-di-(p-dimethylaminobenzyl)-4-pyridone, and N-methyl-3,5-di-(p-phenylbenzyl)-4-pyridone. The number of dibenzylpyridones with substituents of different types, which have been synthesized by this method, serves to demonstrate its generality.

The infrared spectra of both series of compounds were determined; the ultraviolet absorption spectra of N-methyl-3,5-dibenzylidene-4-piperidone and N-methyl-3,5-dibenzyl-4-pyridone were determined and compared.

As a first step in applying aromatization reactions to the synthesis of an azatropolone, two intermediates for the synthesis of substituted 1-azacycloheptane-4,5-diones were prepared. N-Methyl-1-azacycloheptan-4-one was obtained from a Dieckmann cyclization as an unstable free base and as the stable picrate. 1,3,5-Trimethyl-1-azacycloheptan-4-ol-5-one was isolated from an acyloin cyclization as the picrate.

Part II.

Several isolated examples of ultraviolet absorption spectra of α,β -unsaturated amines have shown that this chromophore induces absorption in the same region as does a conjugated diene (3,4).

In order to utilize this characteristic absorption as a diagnostic test for α,β -unsaturation in amines, the ultraviolet absorption spectra have been determined for several groups of α,β -unsaturated, β,γ -unsaturated, and related saturated tertiary amines of quite varied structure: monocyclic five- and six-membered rings, acyclic unsaturates, and fused bicyclic and tetracyclic systems. A definite shift toward longer wave length and higher intensity is observed consistently with the introduction of α,β -unsaturation. By contrast, the introduction of β,γ -unsaturation into the same tertiary amine molecule produces no appreciable change in either the wavelength or the intensity of the ultraviolet absorption. Thus, comparison of the ultraviolet absorption spectrum of an unsaturated tertiary amine with that of the corresponding saturated amine provides a convenient empirical method for differentiating between an α,β -unsaturated amine and one in which the double bond is further removed from the nitrogen.

94 pages. \$1.18. MicA 55-63

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I. A SYNTHESIS OF TRYPTOPHAN AND TRYPTOPHAN ANALOGS.

II. THE SULFUR CONTAINING PRODUCTS OF THE REDUCTIVE CLEAVAGE OF SULFONAMIDES.

(Publication No. 10,510)

John Angus MacDonald, Ph.D.
University of Illinois, 1954

I. A SYNTHESIS OF TRYPTOPHAN AND TRYPTOPHAN ANALOGS

Although a number of syntheses of tryptophan and its analogs have been reported, a shorter route, especially one giving high yields, seemed desirable. It appeared that if acetyltryptophan could be prepared by the addition of indole to α -acetamidoacrylic acid, such a reaction would provide the basis for a ready synthesis of tryptophan. The hydrolysis of acetyltryptophan to tryptophan is a well known reaction.

It was found that the reaction of indole with α -acetamidoacrylic acid in the presence of acetic acid and acetic anhydride does indeed yield acetyltryptophan. Variations in the method of conducting the reaction were studied, and under certain conditions a 57% yield of acetyltryptophan was obtained. Acetyl-2-methyltryptophan and acetyl-7-methyltryptophan were prepared from the corresponding indoles and α -acetamidoacrylic acid by the same method. Indole-2-carboxylic acid and ethyl indole-2-carboxylate did not react with α -acetamidoacrylic acid under conditions similar to those used in the preparation of acetyltryptophan.

The possible involvement of an azlactone, an oxazoline, or diacetylserine as an intermediate in the formation of acetyltryptophan has been investigated and found unlikely.

α -Methoxyacrylic acid reacts with indole to give an acid of unknown constitution.

II. THE SULFUR-CONTAINING PRODUCTS OF THE REDUCTIVE CLEAVAGE OF SULFONAMIDES

In recent investigations it was found that a mixture of hydrobromic acid and phenol was an effective reagent for the recovery of amines from sulfonamides. The fate of the sulfur-containing portions of sulfonamides cleaved by this method has not been well established, but in one case the sulfur-containing product of the reaction was found to be a hydroxy sulfide (p-hydroxyphenyl 2-naphthyl sulfide). The present investigation was undertaken in order to determine whether hydroxy sulfides are general products of the

cleavage of sulfonamides by this reagent. Also, it was hoped that if hydroxy sulfides proved to be general products of the reaction it would be possible to apply the reaction as a synthesis of hydroxy sulfides.

The cleavage of benzenesulfonanilide by hydrobromic acid and phenol resulted in the formation of *p*-hydroxydiphenyl sulfide and a compound believed to be a brominated hydroxy sulfide. These compounds were isolated as the corresponding methyl ethers. The formation of *p*-hydroxydiphenyl sulfide in this reaction supports the view that hydroxy sulfides are the usual sulfur-containing products of reactions of this type. The presence of the supposed bromohydroxydiphenyl sulfide in the reaction mixture further complicates the isolation of *p*-hydroxydiphenyl sulfide from the phenolic compounds present, and would appear to eliminate the possibility of isolating the hydroxy sulfide with sufficient ease for preparative purposes. It is probable that the presence of analogous bromine substituted compounds contributed to the difficulties experienced in attempting to isolate hydroxy sulfides from the products of the cleavage of other sulfonamides.

Combinations of hydrobromic acid and resorcinol, 1-naphthol or 2-naphthol brought about the hydrolysis of 2-naphthalenesulfonanilide. Attempts to isolate the sulfur-containing products of these cleavages were, however, unsuccessful. In the cleavage of 2-naphthalenesulfonanilide by hydrobromic acid and 2-naphthol a phenolic compound which does not contain sulfur was isolated. 68 pages. \$1.00. MicA 55-64

THE PREPARATION OF SOME PHYSIOLOGICALLY ACTIVE COMPOUNDS CONTAINING TWO NITROGEN ATOMS

(Publication No. 10,118)

Fred Eli Martin, Ph.D.
University of Missouri, 1954

Supervisor: Norman Rabjohn

Three series of dinitrogen compounds have been prepared which contain structural groups known for their pharmacological activity. Uniform changes were made in each series so that a correlation between chemical structure and pharmacological activity could be made.

Series I included the β -phenylethyl derivatives of ethylenediamine; i.e., *N*-(β -phenylethyl)ethylenediamine, *N,N'*-di-(β -phenylethyl)ethylenediamine, *N,N*-di-(β -phenylethyl)ethylenediamine, *N,N,N'*-tri-(β -phenylethyl)ethylenediamine, and *N,N,N',N'*-tetra-(β -phenylethyl)ethylenediamine. It was necessary to prepare di-(β -phenylethyl)amine, *N,N*-di-(β -phenylethyl)aminoacetonitrile, and *N,N*-di-(β -phenylethyl)-*N'*-phenylacetyleneethylenediamine as intermediates.

Series II was composed of a number of ω -piperidinoalkylamides: *N*-(4-piperidinobutyl)acetamide, *N*-(4-piperidinobutyl)propionamide, *N*-(4-piperidinobutyl)isobutyramide, *N*-(5-piperidinoamyl)acetamide,

N-(5-piperidinoamyl)propionamide, *N*-(5-piperidinoamyl)isobutyramide, *N*-(6-piperidinohexyl)acetamide, *N*-(6-piperidinohexyl)propionamide, and *N*-(6-piperidinohexyl)isobutyramide. The syntheses of the preceding required the preparation of γ -chlorobutyronitrile, γ -piperidinobutyronitrile, 4-piperidinobutylamine, 5-chlorovaleronitrile, 5-piperidinovaleronitrile, 5-piperidinoamylamine, benzoylpiperidine, pentamethylene bromide, 6-bromocapronitrile, 6-piperidinocapronitrile, and 6-piperidinoethylamine.

Series III consisted of *N*-[4-[2-(*N*-methyl)piperidyl]butyl]acetamide and *N*-[4-[2-(*N*-methyl)piperidyl]butyl]propionamide. The intermediates which were required in this series were diethyl β -(2-pyridyl)ethylmalonate, β -(2-pyridyl)ethylmalonic acid, γ -(2-pyridyl)butyric acid, 3-carbethoxy-4-ketoquinolizidine, γ -(2-piperidyl)butyric acid, γ -[2-(*N*-methyl)piperidyl]butyric acid, γ -[2-(*N*-methyl)piperidyl]butyramide, and 4-[2-(*N*-methyl)piperidyl]butylamine.

The following miscellaneous compounds also were prepared: *N*-(β -cyclohexyl)ethylenediamine, *N,N'*-di-(β -phenylethyl)piperazine, *N,N*-di-(β -phenylethyl)-cyanoacetamide, *N*-(β -phenylethyl)- β -di-(β -phenylethyl)aminopropionamide, β -di-(β -phenylethyl)aminopropionitrile, *N,N*-di-(β -phenylethyl)trimethylenediamine, *N,N*-di-(β -phenylethyl)-*N'*-phenylacetyltrimethylenediamine, and tetraethylurea.

All of the β -phenylethyl derivatives of ethylenediamine were tested as their hydrochlorides for physiological activity. Those compounds which contained the *N,N*-di-(β -phenylethyl) group caused a lowering of the blood pressure in mice and dogs. As the number of β -phenylethyl radicals was increased in the ethylenediamine molecule, the solubilities of the resulting compounds decreased.

Pharmacological tests of the hydrochlorides of the ω -piperidinoalkylamides indicated that in mice and dogs these compounds caused excitation, followed by convulsions at higher dosage levels.

Physiological tests have not been obtained as yet on the compounds of Series III.

127 pages. \$1.59. MicA 55-65

THE EFFECT OF SUBSTITUENTS ON THE CATALYTIC HYDROGENOLYSIS OF BENZYLAMINES

(Publication No. 10,436)

Nathaniel L. Remes, Ph.D.
University of Connecticut, 1954

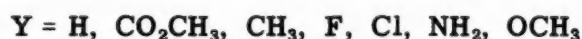
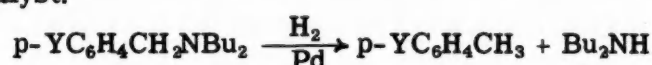
The object of this investigation was to study the effect of substituents upon the hydrogenolysis of the carbon-nitrogen bond in benzylamines. The literature survey includes a critical review of the structural factors affecting the stability of the carbon-nitrogen bond toward hydrogenolysis and a discussion of the selectivity of catalysts used in hydrogenolysis.

The experimental work includes (1) the development of a general procedure for the hydrogenolysis of

saturated aliphatic amines, (2) a study of the hydrogenolysis of nuclear-substituted benzyldibutylamines, and (3) a comparison of the relative rates of hydrogenolysis of primary, secondary, and tertiary amines, and their salts containing the benzyl group.

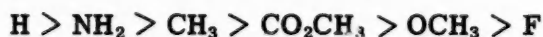
The hydrogenolysis of saturated aliphatic amines was carried out in the presence of a palladium catalyst, using Tetralin as the source of hydrogen. On the basis of these experiments, the cleavage of saturated aliphatic amines appears to be a general reaction. The presence of an activating group is not required to affect the hydrogenolysis of the carbon-nitrogen bond at the boiling point of Tetralin.

The hydrogenolysis of a series of para-substituted benzyldibutylamines was carried out in a Parr apparatus at $20.0 \pm 0.1^\circ$ in the presence of a palladium catalyst.



The rates were followed by observing the pressure change as a function of time. The effect of the products upon the rate of reaction was investigated by carrying out the hydrogenolysis of benzyldibutylamine in the presence of the different reaction products.

The rate of hydrogenolysis of benzyldibutylamine was found to be initially first order with respect to the hydrogen pressure and zero order with respect to the concentration of the substrate. The rates of hydrogenolysis of the para-substituted benzyldibutylamines decreased in the following order:



In the hydrogenolysis of benzylamine, benzylbutylamine, benzyldibutylamine, and benzyldibutylmethylammonium chloride, the relative rates of hydrogenolysis decreased in the order: tertiary > secondary > primary. The quarternary salt underwent hydrogenolysis at the same initial rate as the tertiary amine, but unlike the latter, its rate did not decrease with time.

The relative rates of hydrogenolysis of the nuclear-substituted benzyldibutylamines do not support an ionic or a radical mechanism. The experimental data can be rationalized if the rate of hydrogenolysis is assumed to be proportional to the specific adsorption of hydrogen, i.e., the amount of hydrogen adsorbed per unit weight of catalyst. The falling off of the rate curves is considered to be due to poisoning of the catalytic surface by dibutylamine and the substrate. This interferes with the adsorption of hydrogen on the catalytic surface. Differences in the overall rates of reaction of the nuclear-substituted benzyldibutylamines are attributed to the differences in the degree of adsorption at the substituent. Similarly, differences in the degree of adsorption on the catalytic surface can explain the observed differences in rates of hydrogenolysis of certain primary, secondary, and tertiary amines containing the benzyl group.

117 pages. \$1.46. MicA 55-66

THE DESATURATION OF SPARTEINE AND RELATED MODEL AMINES

(Publication No. 10,555)

Paul David Thomas, Ph.D.
University of Illinois, 1954

Leonard and Gash (J.A.C. S., 76, 2781 (1954)) have reported a method for the determination of the proximity of nitrogen to a double bond by comparison of the infrared spectra of an unsaturated free base and its salts. The absorption maximum in the double bond stretching region does not shift appreciably in going from a β,γ -unsaturated amine to its salts. By contrast, a decided shift toward higher wave numbers is observed in going from an α,β -unsaturated amine (enamine) to its salts, corresponding to the structural transformation: $\text{>C=C-N<} \xrightarrow{\text{H}^+} \text{>CH-C=N}^+ \text{<}$.

The aims of this research were: 1) to determine the location of double bonds introduced into sparteine and some structurally related amines containing a nitrogen atom at the bridgehead by mercuric acetate and sodium hypobromite desaturation; 2) to obtain evidence concerning the proposed shift of the double bond in going from an α,β -unsaturated amine to its salts; 3) to study the reactions of the grouping $\text{>C=N}^+ \text{<}$, especially as to chemical reduction and attack by nucleophilic reagents.

Mercuric acetate desaturation of 1-sparteine at room temperature according to the procedure of Winterfeld (Arch. Pharm., 266, 299 (1928)) afforded an enamine which has been assigned the Δ^5 -structure. The Δ^2 -structure was eliminated on the basis of results obtained upon mercuric acetate desaturation of (-) octahydropyrrocoline. Such desaturation gave rise to an optically inactive enamine which was identical to the mercuric acetate desaturation product of racemic octahydropyrrocoline. Thus, the hydrogen atom on the asymmetric bridgehead carbon atom must have been removed. α -Didehydrosparteine, which is obtained by more vigorous mercuric acetate treatment, has been assigned the $\Delta^{5,11}$ -diene structure. Mild mercuric acetate treatment of 1- α -isosparteine afforded Δ^5 -dehydro- α -isosparteine. trans-1-Methyl-decahydroquinoline yielded 1-methyl- \bar{X} -hydroxy- $\Delta^{4a(8a)}$ -octahydroquinoline.

The proposed shift of the double bond in going from an α,β -unsaturated amine to its salts has been substantiated by chemical evidence. Using the perchlorate salt of Δ^5 -dehydrosparteine ($\Delta^{11(6)}$ -dehydrosparteinium perchlorate) as a model compound nucleophilic attack has been shown to take place with Grignard reagents and cyanide ion to afford 6-substituted sparteines. Such attack can only be accounted for due to the presence of the grouping $\text{>C=N}^+ \text{<} \longleftrightarrow \text{>C=N}^+ \text{<}$.

The 6-substituted sparteines prepared were: 6-methyl-, 6-ethyl-, 6-n-propyl-, 6-n-butyl-, 6-benzyl-, 6-(p-methoxybenzyl)- and 6-cyanosparteine. That these were not 2-substituted sparteines has been shown by comparison of the properties of dl-6-methylsparteine and dl-2-methylsparteine which had been

reported by Winterfeld and Hoffmann (Arch. Pharm., 275, 5 (1937)). Treatment of $\Delta^{1(6)}, 11(16)$ -didehydro-sparteinium diperchlorate with potassium cyanide afforded 6,11-dicyanosparteine.

$\Delta^{1(6)}$ -Dehydrosparteinium bisulfate has been reduced by sodium borohydride and under Clemmensen conditions to 1-sparteine in good yield. Formic acid reduction of several cyclic enamines and dehydrosparteine (NaOBr) has been accomplished; such reduction has been proposed to involve the >C=N^+ intermediate.

Zerewitinoff active hydrogen determinations of several salts of enamines obtained by mercuric acetate desaturation have also borne out the proposed shift of the double bond.

Sodium hypobromite desaturation of 1-sparteine afforded a β, γ -unsaturated sparteine. Catalytic reduction of dehydrosparteine (NaOBr) has been shown to yield 1-sparteine and not pseudosparteine as reported by Wolffenstein and Reitmann (Biochem. Z., 186, 269 (1927)). 153 pages. \$1.91. MicA 55-67

THE ACTION OF GRIGNARD REAGENTS ON β -BENZOPINACOLONES

(Publication No. 10,564)

Philip Erwin Wiegert, Ph.D.
University of Illinois, 1954

Introduction: The condensation of a Grignard reagent with an aromatic ketone in such a way as to involve an aromatic ring appears to have been realized first by Schmidlin and Wohl in 1910 who prepared 1-triphenylacetyl-2-phenyl-1,2-dihydrobenzene by the action of phenylmagnesium bromide on β -benzopinacolone. (1) Unfortunately these authors believed their compound to be pentaphenylethanol and it remained for Mosher and Huber (2) working thirty-three years later to establish the identity of the compound.

In the meantime many conjugate addition reactions involving an aromatic ring had been described and it had been found possible to effect them by deliberate introduction of steric hindrance. Radicals of the mesityl type had been shown to be particularly suitable.

In the light of the new interpretation, the experiment of Schmidlin and Wohl falls in this category also; the triphenylmethyl radical must exert an effect similar to that of mesityl. The present investigation was undertaken to determine the range over which the analogy is valid.

Discussion: When duryl phenyl ketone was treated with benzylmagnesium chloride and *t*-butylmagnesium chloride, *para*-alkylated products were formed. (3) It is commonly supposed that these compounds were formed by a 1,6-addition process. The present investigation has revealed that the trityl group confers many of the properties on aryl ketones that radicals of the mesityl type do. (4) Treatment of β -benzopinacolone with *t*-butyl, *t*-amyl, and benzyl Grignard

reagents resulted in the formation of *para*-alkylated products. The *t*-amyl and *t*-butyl reagents were also able to displace an acetoxy group from the *para*-position. This result, too, was in accord with the results reported with the analogous *p*-acetoxyphenyl duryl ketone. (5) Displacement of a methoxyl group from the *para*-position has also been realized in the β -benzopinacolone series but in very low yield. The replacement of a *para*-methoxyl group is quite difficult to effect and only the more powerful Grignard reagents seem able to do so. However, when the orientation of the methoxyl group was *ortho*, replacement was greatly facilitated, and was effected with both phenyl and methyl Grignard reagents. Similar results have been reported for the aromatic ketones which contain radicals of the mesityl type.

Condensation of triphenylmethylsodium with substituted benzoyl chlorides was found to be a very satisfactory method of preparation for many substituted β -benzopinacolones. (4)

When *p*-anisyl trityl ketone was treated with benzylmagnesium chloride, the ketone was cleaved and the triphenylmethyl portion of the molecule combined with a benzyl group to form 1,1,1,2-tetraphenylethane. 77 pages. \$1.00. MicA 55-68

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CHEMISTRY, PHARMACEUTICAL

ANALYSIS OF ACORN OIL

(Publication No. 10,424)

Natividad Feliciano de Castro, Ph.D.
University of Connecticut, 1954

The fixed oil obtained from the acorns of *Quercus rubra* L., was examined and its physical and chemical properties are recorded. The oil was analysed by the application of chromatographic as well as standard procedures.

The unsaponifiable portion was subjected to elution analysis using four solvents of increasing eluting power in succession. Hydrocarbons, wax, pigments and beta-sitosterol were identified.

The fatty acids were separated by low temperature fractionation, chromatography, the lead salt-ether method and bromination. Attempts to utilize certain new solid brominating agents were unsuccessful.

Artificial mixtures of fatty acids were analysed by chromatographic method using the following combinations of adsorbent and solvent: Alumina with bromthymol blue and petroleum ether; heavy magnesia with phenol red and petroleum ether; heavy magnesia with phenolphthalein and petroleum ether; silicic acid with bromcresol green and butanol-chloroform; silicic acid with "R-NH₄ Indicator" and butanol-chloroform; and silicic acid and benzene using mercury iodocyanide as streak reagent. The last procedure, having been successful, was used in the analysis of acorn fatty acids.

Oleic, linoleic, stearic and palmitic acids were isolated and identified. 46 pages. \$1.00. MicA 55-69

THE PREPARATION AND PHYSICOCHEMICAL STUDIES OF THE METALLIC SALTS OF URSOLIC ACID

(Publication No. 10,425)

Henry Eisen, Ph.D.
University of Connecticut, 1954

Ursolic acid is a naturally occurring pentacyclic monohydroxy-monocarboxylic triterpenoid compound of the α -amyrin group. The objectives of this work were to prepare alkanolamine salts of ursolic acid for purposes of increasing water solubility of the acid and concomitantly increasing its surface active properties; to prepare amino ester and substituted amide derivatives of the acid; and to prepare a series of metallic salts of ursolic acid and study their physicochemical properties.

The crude ursolic acid as supplied by the National Cranberry Association was obtained by extraction of cranberry skins. For its purification best results were obtained by use of a procedure in which the alcohol-soluble portion of the crude acid was decolorized by several treatments with Norit A, followed by recrystallization of the partially purified acid from ethanol. A 20 per cent total yield of purified ursolic acid was obtained from the crude product in this manner.

Various attempts to synthesize a number of nitrogen derivatives of ursolic acid and acetyl ursolic acid, e.g., alkanolamine and alkamine salts, amino esters, and substituted amides proved to be unsuccessful when employing standard methods of reaction. This anomalous behavior is believed to be due to steric hindrance in the ursolic acid molecule.

A series of metallic salts of ursolic acid was prepared by the usual double decomposition method, except for sodium and potassium ursolates, which were prepared by neutralization with sodium and potassium hydroxides, respectively. Stannic and zirconium ursolates are new compounds which have not been previously reported in the literature.

Analysis of the salts was accomplished on a micro basis by passing a butanol-solution of the salt through a column of Dowex 50, a cation exchange resin, and titrating the effluent with standard base. Exchange

equivalents, percentage purity, and percentage metal are given for 21 metallic ursolates.

Application of the Liebermann-Burchard test to the metallic ursolates indicated a wide variety of colors produced by the respective salts. The results obtained in this test are presented.

A preliminary study of lithium, sodium, and potassium ursolates as emulsifying agents in cod liver oil, liquid petrolatum, turpentine oil emulsions, and benzyl benzoate lotion, show that these compounds are effective emulsifiers in small concentrations. This study seems to indicate that the stability of the emulsions is influenced in part by the quantity and nature of the emulsifier and the inherent properties of the oily phase.

A preliminary study of the water absorption properties of the metallic ursolates in petrolatum was made, using a cholesterol-petrolatum base as the control. The results, which are given as water absorption values, indicate no correlation between water absorption and emulsifier efficiency.

65 pages. \$1.00. MicA 55-70

PHYTASE AND PHOSPHORUS DISTRIBUTION IN ALFALFA

(Publication No. 10,337)

James Bruce Martin, Ph.D.
Purdue University, 1949

Major Professor: D.M. Doty, Prof. Quakenbush

Since the phosphorus in many feed materials, especially the cereal grains, occurs largely as the relatively unavailable phytic acid or phytate salts, a study was made to determine (1) whether phosphorus of alfalfa occurs as phytic acid and to what extent it occurs in more available forms, and (2) whether a phytate-splitting enzyme is present in alfalfa plants and if so, how important it may be in increasing availability of phosphorus in the diet of farm animals.

A method was developed for the separation of the phosphorus-containing compounds of alfalfa tissue into inorganic, phospholipid, water-soluble organic, and water-insoluble organic phosphorus. Alfalfa samples grown on soils at different levels of phosphorus fertility were analyzed by this method. Only the inorganic phosphorus showed substantial variations with the different levels of fertility. This indicated that inorganic phosphate is the form of phosphorus stored under conditions of luxury consumption of phosphorus by alfalfa. This finding provides a scientific basis for the validity of "quick tests" which measure the amount of inorganic phosphorus present in the plant sap.

Alfalfa leaves and stems were not found to contain a measurable amount of phytin or phytic acid. However, the presence of phytase (phytin-splitting enzyme) was demonstrated, and the active enzyme was partly separated from the other components of the tissue. The possibility that alfalfa phytase in rations

may play a significant role in digestion of phytin phosphorus appears unlikely, first, because the alfalfa phytase was found to be unstable in the acid conditions which prevail in the stomach and, second, because the low phytase activity of the alfalfa present (for example, in a chick ration) could be expected to liberate only a small percentage of the phosphorus requirement of the chick.

107 pages. \$1.34. MicA 55-71

CHEMISTRY, PHYSICAL

EXCITED ELECTRONIC STATES IN N,N,N',N'-TETRAMETHYL-p-PHENYLENEDIAMINE AND p-DIMETHOXYBENZENE

(Publication No. 9998)

Andreas Christoph Albrecht, Ph.D.
University of Washington, 1954

The method of polarized photo-oxidation is employed to determine the relative polarizations of two electronic absorption bands in N,N,N',N'-tetramethyl-p-phenylenediamine. The absorption characteristics in the visible spectral region of single crystals of Wurster's Blue perchlorate are studied. Wurster's Blue is the product of the photo-oxidation and is related to the diamine. Since the crystal structure of the perchlorate salt is known, it is possible to determine the absolute polarizations of absorption in the diamine from the relative results of the photo-oxidation experiments. A general analysis of the polarized photo-oxidation experiment is presented.

Single crystals of p-dimethoxybenzene are investigated by the method of crystal spectra. The gross absolute polarizations of absorption in two electronic absorption bands are determined. A first approximation to a detailed analysis of the bands into x, y, and z components is also obtained. The results are tentatively explained on the basis of the presence of "forbidden" character in the absorption bands.

The findings of the investigations carried out on the two benzene derivatives are discussed and symmetry species assignments are made for excited electronic states of the compounds. Arguments are presented which lead to symmetry species assignments for two excited electronic states in benzene associated with absorption in the 2600Å and 2000Å regions.

Absolute polarizations of absorption in three bands of Wurster's Blue are obtained as a result of the polarized photo-oxidation studies coupled with the observations made on the single crystals of Wurster's Blue perchlorate. The significance of the polarizations is discussed in light of the possible spectroscopic behavior of Wurster's Blue as both a free radical and a benzene derivative.

134 pages. \$1.68. MicA 55-72

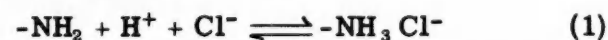
INTERACTION OF POLYAMIDES WITH ACIDS AND BASES

(Publication No. 10,449)

Alexander Beresniewicz, Ph.D.
University of Illinois, 1954

Nylon (66) is a condensation copolymer of a dibasic acid with a diamine; it has therefore both carboxyl and amino end groups which are capable of interacting with acids and bases.

When hydrochloric acid is absorbed on nylon having more amino than carboxyl end groups, the protons react first with the more basic excessive NH_2 groups, and, after those are virtually gone, with the COO^- ions. These reactions, in which an equivalent amount of chloride ions is simultaneously absorbed on the $-\text{NH}_3^+$ ions in order to maintain electric neutrality, are represented below:



Determined values of the equilibrium constants and of ΔF° , ΔH° and ΔS° for both stages of absorption are given below:

Temp. in $^\circ\text{C}$.	$K_1 \times 10^{-9}$	$\Delta F_1^\circ (\text{Kcal.})$	$\Delta H_1^\circ (\text{Kcal.})$	$\Delta S_1^\circ (\text{e.u.})$
14.0	31	-13.8		
34.7	9.4	-13.8	-13.5	0.5
50.0	2.1	-13.9		

Temp. in $^\circ\text{C}$.	$K_2 \times 10^7$	$\Delta F_2^\circ (\text{Kcal.})$	$\Delta H_2^\circ (\text{Kcal.})$	$\Delta S_2^\circ (\text{e.u.})$
18.0	6.2	-10.4		
34.8	3.7	-10.7	-6.4	13.7
55.5	1.7	-10.9		

At higher equilibrium concentrations of the acid the amide groups of nylon interact with HCl. The data obtained in this region of absorption have been interpreted in terms of the Freundlich absorption isotherm.

The interaction of nylon having a great excess of carboxyl end groups with sodium hydroxide has also been studied. The addition of NaOH to such a nylon is at first exothermic, but becomes endothermic with increasing equilibrium concentrations of the base. Below pOH 1 the base begins to interact with the amide groups; for this reason nylon may be regarded as being a doubly amphoteric polyelectrolyte.

110 pages. \$1.38. MicA 55-73

**PHYSICAL CHEMISTRY OF FIRE FIGHTING FOAM
AND FOAMING AGENTS: PHASE I: STUDIES ON
BUBBLE SIZES AND BUBBLE SIZE DISTRIBUTION
PHASE II: STUDIES ON THE BEHAVIOR
OF SINGLE FILMS**

(Publication No. 10,066)

Richard Chi-cheng Chang, Ph.D.
Syracuse University, 1954

This study is a part of a project sponsored by the U. S. Army Engineer Research and Development Laboratories. The major purpose of this project is the development of superior water additives for combatting Class A and Class B fires. Since the physical chemistry of these water additives is closely related to their effectiveness in fire fighting, this part of the project is mainly devoted to studies on the physical chemistry of foam and foaming agents.

Two phases are involved in this study: one is on the bubble sizes and bubble size distribution of foam and the other is on studies of the behavior of single films formed by surfactant solutions.

Under Phase I, the effect of freezing on the structure of foam was studied. It was found that the bubble sizes and bubble size distribution were not significantly changed by freezing. A comparison of bubble sizes and bubble size distribution on the surface of foam and that the inside of the foam mass was made. Again, no significant deviation of the average bubble sizes or bubble size distribution was found. The relationship between expansion ratio and bubble sizes and bubble size distribution of foam was then investigated using two types of foam generators: a Blackmer sliding vane pump generator and a centrifugal pump generator. In both cases, a packing column was inserted in the system as a refining section which served the purpose of further subdividing the bubbles. Results indicated that bubble sizes and bubble size distribution are affected by expansion ratio, although other factors such as the nature of the foaming agents, concentration of solution, inlet air pressure, type of generating system, and the height and/or condition of the refining section are also of importance in determining the foam dispersity. It was also noted that the pressure drop across the packing column was directly affected by the foam dispersity. The average bubble sizes and bubble size distribution were studied by taking photomicrographs of the foam with a photomicrographic camera. The photomicrographs obtained were computed with the help of a comparator or a Bausch and Lomb 81-34-97-20 type focusing magnifier. Samples of these photomicrographs of the above studies are presented in the thesis. A few photographs showing changes of bubble sizes and bubble size distribution during the drainage are also included in the thesis.

Phase II is mainly concerned with observations of light interference phenomena on single films formed by various surfactant solutions. Sixteen different surfactants were used and each one was observed at several different concentrations. The light interference pattern formed on films of these surfactant solutions seemed to fall into two main categories. In

one category the pattern is formed of horizontal parallel color bands which move in the direction of the gravitational force. At the sides near the frame there appears to be a region of considerable turbulence. Streams and swirls move upward and toward the center of the film. The second category develops color bands along the top and the two sides. The rate of movement of the bands was much slower in the second pattern than that in the first. A possible explanation of these phenomena is given in the thesis.

The effect of concentration of solution on the rate of thinning of films was investigated. For the same surfactant, an increase in bulk concentration of the surfactant solution decreases the thinning rate during the major part of the thinning process (as judged by the descent of the second order violet band); while the final thinning rate (as judged by the descent of the "black film boundary") increases with increase in bulk concentration. The results indicate that two different mechanisms are involved in the film thinning process.

Some work was also included showing the effect of temperature and the effect of liquid level in contacting with film, on the film thinning rate. The results indicated that the thinning rate of films increases with increase in temperature and the thinning rate of films is remarkably decreased when the bottom of the film is in contact with bulk solution.

Under Phase II, it was also attempted to measure a "breakpoint thickness" of single films by weighing the film at the time when it breaks. However, the results were not considered as satisfactory because the film thicknesses so obtained were too large in magnitude. 206 pages. \$2.58. MicA 55-74

**CHEMICAL EFFECTS OF THE NUCLEAR
REACTION $N^{14}(n,p)C^{14}$ IN CRYSTALLINE
AMMONIUM SULFATE AND BERYLLIUM NITRIDE**

(Publication No. 10,463)

Wilmer Ray Cornman, Jr., Ph.D.
University of Illinois, 1954

I. INTRODUCTION

When nitrogen compounds are irradiated with slow neutrons, the nuclear reaction



takes place. The C^{14} particle is a negative beta emitter, having a half-life of about 5600 years. The energy Q released in the process is approximately 600 Kev. of which 560 Kev. is imparted to the ejected proton and 40 Kev. to the recoiling carbon particle. The recoil energy is approximately 10,000 times chemical bond energies, so that the parent bonds of the newly-formed recoil carbon particle are always ruptured.

II. EXPERIMENTAL

An ammonium sulfate target was irradiated with thermal neutrons in the reactor of the Argonne

National Laboratory for a period of one to two months. A beryllium nitride target was prepared and irradiated with thermal neutrons at the Oak Ridge Laboratories. The final chemical forms assumed by the carbon particles produced in the nuclear reaction were determined by employing the following procedure:

- (1) Solution of a sample of the target in an appropriate solvent;
- (2) Addition of likely inactive one-carbon compounds in macroscopic amounts as carriers;
- (3) Separation and oxidation of the carriers to carbon dioxide;
- (4) Determination of the radioactivity in the separated and oxidized carriers, and calculation of the percent activities of the species represented by these carriers.

III. RESULTS

The distributions of the radiocarbon among the various one-carbon compounds for the two irradiated targets are given in Table 1.

TABLE 1

Distribution of Radiocarbon Atoms

Chemical Species	Percent Activities	
	(NH ₄) ₂ SO ₄	Be ₃ N ₂
CO ₂	43.0	13.5
CO	2.0	0.06
CH ₄	0.5	25.4
HCN	3.9	6.3
CH ₃ NH ₂	16.2	3.8
HCOOH	15.5	8.0
HCHO	13.2	2.3
CH ₃ OH	1.0	0.1
CO(NH ₂) ₂	7.3	6.5
H ₂ NCN	-	4.5
CH ₃ NHNH ₂	-	10.7
C(NH)(NH ₂) ₂	-	18.2
Total	102.6 ± 3.0	99.4 ± 3.0

The solvents used were water for ammonium sulfate and 2 N aqueous sulfuric acid for beryllium nitride.

IV. DISCUSSION

Models for the energy loss process and for the entrance of the recoiling carbon particle into chemical combination are proposed to account for the main features of the distributions found in Table 1. A comparison is made between the distributions in these compounds and the distributions in irradiated ammonium chloride and bromide which had been analysed previously. 192 pages. \$2.40. MicA 55-75

THE HIGH PRESSURE OXIDATION OF THE SYSTEM NITROETHANE-95% NITRIC ACID

(Publication No. 10,426)

Charles Buford Euston, Ph.D.
University of Connecticut, 1954

In the combustion of nitroparaffin-nitric acid mixtures, the consumption rates increase with increasing pressure. Further, the combustions are characterized by sharp transitions from slow, normal burns to fast, turbulent burns at definite reproducible pressures, the values of which vary with the system under consideration. To investigate the reasons for the abrupt change in consumption rate at this "break" pressure, the oxidation of the nitroethane-95% NHO₃ system was studied by a strand burning technique over the pressure range 500-10,000 psig. in nitrogen and helium atmospheres.

The high pressure reaction vessel used was of special design, containing four diametrically opposed pyrex windows to permit visual observation of the combustion process. High pressures were obtained by displacement with mechanically pumped SAE-10 motor oil. Linear consumption rates were timed both manually, with 1/100 second interval timers and by means of high speed motion pictures, at film speeds between 250 and 3,000 frames per second.

The results obtained are tabulated below.

1. No change in consumption rate was observed on changing the pressurizing gas from nitrogen to helium.

2. Mixtures containing 1.5, 1.0 and 0.5 times the amount of HNO₃ required by the over-all equation $5C_2H_5NO_2 + 9HNO_3 = 10CO_2 + 7N_2 + 17H_2O$ gave break pressures of 2300, 1400 and 1900 psig., respectively. The stoichiometric mixture burned faster than both oxidizer-rich and fuel-rich mixtures at all pressures. The oxidizer-rich mixture burned faster than the fuel-rich mixture below 1900 psig., but above this pressure the order was reversed. All burns below the break pressures were normal; those above the break pressures were turbulent.

3. At 2500 psig., mixtures having HNO₃ concentrations between 23.3 and 65.3 mole per cent showed a maximum in rate for the stoichiometric ratio, with a rather symmetrical falling off to low rate values on both the oxidizer-rich and fuel-rich sides. At 750 psig., the rates increased with HNO₃ concentration up to a maximum at the stoichiometric point, but oxidizer-rich fuels showed no great falling off of consumption rate. The order of reaction at 750 psig. was calculated to be second over the fuel-rich concentration range.

4. The electrical conductivity of the mixtures over the pressure range from atmospheric to 2500 psig. showed no change at the break pressure.

5. Mass spectrographic analyses of the final combustion products showed the presence of CO₂, N₂ and H₂O for all mixtures. With fuel-rich mixtures the presence of CO was indicated. With oxidizer-rich mixtures, excess oxygen and nitrogen appeared in the

spectrum, possibly as a result of the formation and subsequent decomposition of oxides of nitrogen.

6. Temperature studies with hot wires showed the existence of a sharp temperature gradient between the flame zone and the liquid surface.

7. As the initial temperature of the strands was increased, the same effect was observed as is with increasing pressure, in that the burns change from slow and normal to fast and turbulent at a specific temperature. The rates at these "break temperatures" agreed with the rates at the break pressures. Plots of log rate versus the reciprocal of the initial temperature afforded energy values for stoichiometric mixtures at 1000 psig. of 1480 calories below the break temperature and 5180 calories above. Corresponding values for a fuel-rich mixture at 1500 psig. the values were 1297 and 11,700 calories. These were 1273 and 14,070 calories. For an oxidizer-rich mixture at 1200 psig. the values were 1297 and 11,700 calories. These values are not true activation energies, since the initial temperature of the strand is considerably lower than the actual reaction temperature, but any change in these energies would indicate a like change in activation energy.

These results indicate that increasing pressure causes a decrease in the flame to surface distance, with a corresponding increase in the surface temperature, and hence the consumption rate, of the fuel mixture. In addition, it is evident that a change in mechanism, brought about by the attainment of a specific reaction temperature, occurs at the break pressure.

108 pages. \$1.35. MicA 55-76

**THE ACCOMMODATION COEFFICIENTS
OF THE INERT GASES ON ALUMINUM,
TUNGSTEN, PLATINUM, AND NICKEL AND THEIR
DEPENDENCE ON SURFACE CONDITIONS**

(Publication No. 10,107)

John William Faust, Jr., Ph.D.
University of Missouri, 1954

Supervisor: Lloyd B. Thomas

The accommodation coefficient of the inert gases on aluminum, tungsten, platinum, and nickel (commercial grade Nickel "A") were studied by techniques which were believed to yield clean surface values. Increases of the accommodation coefficient with time following flashing or deposition of evaporated films were followed.

The aluminum surfaces were prepared in the experimental tubes by evaporation from three neighboring filaments over to tungsten and platinum filaments. The observed accommodation coefficients varied widely between coats, and the emissivity increased with each evaporation. Correlation of the accommodation coefficients and emissivities showed that the aluminum surfaces with the lower emissivities tend to have the lower accommodation coefficients suggesting that roughness is the cause of the wide variation in the observed accommodation coefficients. Both emissivities and accommodation coefficients

were decreased when the aluminum coat was heated to near 800°C. Using the emissivity calculated for this coat as that characteristic of a smooth aluminum surface and ascribing the higher apparent emissivities of the other aluminum surfaces to roughness, a roughness factor was calculated that when applied to the observed accommodation coefficients gave a much improved set of values. The data, averaged for approximately twelve aluminum surfaces, give as the probable upper limits to the accommodation coefficient values on a smooth aluminum surface at filament temperatures of 145°C. and 210°C. respectively: He, 0.073 (± 0.010), 0.074 (± 0.014); Ne, 0.159 (± 0.028), 0.163 (± 0.035); and A, 0.343 (± 0.064), 0.334 (± 0.066). It is believed that the values are to be classed as clean surface values rather than gas-saturated values. The terms in parentheses are the average deviation from the mean.

An aluminum getter method of obtaining and holding a clean vacuum system was used. This gave "clean surface" accommodation coefficient values comparable with those in the literature and slower time changes than previously reported. The values of the accommodation coefficients at 145°C. by this method are for tungsten: He, 0.060; Ne, 0.087; A, 0.465; Kr, 0.519; and platinum in ungettered tubes: He, 0.055; Ne, 0.28 (doubtful clean value) at a filament temperature of 145°C. and A, 0.595 at a filament temperature of 210°C.

The accommodation coefficients measured on a tungsten filament from which a deposit of aluminum has been removed by flashing are: He, 0.031; Ne, 0.112; and A, 0.396 at 140°C. This value for helium is the lowest found and was observed four times over a three day period.

The variation of the accommodation coefficient with time was found for all gases investigated in platinum and tungsten. The cause of this time rise is associated with gases being desorbed from the vacuum system (presumably the glass walls) rather than the admitted gas samples. Controlled contamination studies indicate that oxygen could be the contaminating substance whereas mercury is not. On gas saturated surfaces, a desorption effect was found when the filament temperature was raised to a higher value and a subsequent readsorption effect when the filament temperature was lowered again.

No evidence was found that our sample of nickel could be cleaned by flashing.

170 pages. \$2.13. MicA 55-77

THE EFFECT OF PRESSURE ON THE
ELECTROLYTIC PROPERTIES OF SOLUTIONS:
A. CONDUCTANCE OF POLYELECTROLYTES
UNDER PRESSURE. B. TRANSFERENCE NUMBERS
OF ELECTROLYTES UNDER PRESSURE.

(Publication No. 10,481)

Stanley Jensen Gill, Ph.D.
University of Illinois, 1954

Part A. Conductance of Polyelectrolytes
under Pressure

The conductivities of dilute aqueous solutions of potassium chloride, hydrochloric acid, acetic acid, polyacrylic acid, styrene-maleic acid copolymer, polyvinyl potassium sulfate, and a series of sodium phosphates were measured at 25°C and pressures up to 1000 bars.

The degree of dissociation of polyacrylic acid was observed to be a linear function of pressure with the pressure coefficient a function of the concentration. The results are treated thermodynamically to obtain volume changes attending the process of ionization. The volume change associated with the ionization of polyacrylic acid at zero degree of ionization is estimated to be -17.9 ml per mole of carboxyl groups, but with increasing degree of dissociation the volume change becomes less negative. The data are interpreted theoretically on the basis of a simple spherical model for the polyion.

The sodium phosphates showed an increasing pressure coefficient of conductance with increasing chain length.

Part B. Transference Numbers of Electrolytes
under Pressure

A method for determining transference numbers of simple electrolytes under high pressure has been investigated. The method is an adaptation of the conventional moving boundary technique. The position of the boundary is detected by resistance measurements. Results are in good agreement with literature values at 1 atm. for the solutions studied, namely, 0.1 N KCl, NaCl, and HCl. A 2% decrease in cation transference number was observed for 0.1 N KCl at 1000 bars. A larger decrease was noted for 0.1 N NaCl. A slight increase was observed for the cation transference number of 0.1 N HCl. The cation transference number of CdCl₂, which was calculated from the Kohlrausch regulating function and conductivity data, decreased with increasing pressure.

123 pages. \$1.54. MicA 55-78

THE THERMAL ACCOMMODATION OF HELIUM,
NEON, AND ARGON ON CLEAN TUNGSTEN
FROM 77° TO 303°K

(Publication No. 10,132)

Walter Lawrence Silvernail, Ph.D.
University of Missouri, 1954

Supervisor: Lloyd B. Thomas

The thermal accommodation coefficient (AC) is a term used to express the fractional efficiency of the energy exchange at a gas-solid interface. The AC is usually measured by the so-called "hot-wire" method in which the power conducted away from an electrically heated filament by gas at low pressure is compared with that calculated from kinetic theory. In 1930 J. K. Roberts of Cambridge found that when a tungsten filament was flashed at temperatures sufficiently high to drive off all surface contaminants, the AC values observed after flashing were low at first but increased rapidly with time. In order to get the clean surface AC values, Roberts extrapolated back to zero time sets of points taken as the surface became recontaminated. This method was used to obtain presumed clean surface AC values for helium and neon on tungsten at 79°, 195°, and 295°K. These values, (.025, .046 and .057 for helium and .08, .08, and .069 for neon at the above temperatures) are of interest because sole reliance has been placed upon them for check on theories of gas-solid energy exchange.

In the present work AC values of helium, neon, and argon have been determined on clean tungsten at 77°, 90°, 113°, 153°, 193°, 243°, and 303°K. The AC values were obtained by the hot-wire method on a filament .0015" in diameter and 36 cm long with a single potential lead .0003" in diameter used in such a way as to allow conductivity measurements to be taken essentially over the middle third of the filament. A large surface of mischmetal, evaporated onto the inner surface of the tube, acted as a "getter" for impurity species in the system. This technique resulted in a much slower rate of contamination of the clean surface than had previously been observed and allowed sets of AC values, taken at intervals after flashing the filament to 2000°C, to be extrapolated with confidence back to the time of flashing to get the clean surface AC value. This getter technique appears to be a distinct improvement over the circulation over charcoal technique used by Roberts.

The AC of helium on clean tungsten was observed to be about .016 at +30°C and to decrease linearly to about .0119 at -196°C.

The AC of neon on clean tungsten was observed to be about .042 at +30°C, to decrease slightly to about .040 at -80°C, and then to increase to about .05 at -196°C.

Argon showed a definite increase in the AC as the temperature was lowered, going from about .30 at +30°C to about .51 at -196°C. It is suggested that in the case of argon the observed increase in the AC at lower temperatures may be due to increased coverage of the tungsten surface with argon atoms.

In view of the sharply revised and augmented measurements presented, a new theoretical consideration of the AC values or a new application of

existing theory to the values would appear to be in order.

102 pages. \$1.28. MicA 55-79

ECONOMICS

ECONOMICS, GENERAL

A CONSIDERATION OF THE FACTORS
CONDITIONING THE ECONOMIC
DEVELOPMENT OF PAKISTAN

(Publication No. 10,443)

Barkat Ali Azhar, Ph.D.
University of Illinois, 1954

In this study, an attempt has been made to find answers to the following questions:

(1) What are the major social, political and economic obstacles in the way of economic development of Pakistan?

(2) What can be done to overcome these initial obstacles?

(3) What are the future possibilities for the economic development of the country?

(4) What are the major limitations?

(5) What sort of economic policy would be best suited for rapid development of the country?

(6) What are some of the specific suggestions resulting from the preceding analysis?

In the absence of a well-established theory of economic development, suitable for the underdeveloped countries, the analysis was done in a framework of the needed elements in such a theory. The needed elements were selected after much deliberation and study, keeping in mind neither to render the analysis too spotty by excluding some important factors, nor make it too cumbersome by including factors of relatively minor importance. These elements are: natural resources, capital, population, technology and government. It would appear that the list includes all the important economic, political and social factors which together determine the rate of economic growth. A distinction has been made between the elements that are responsible for the initiation of the process of economic development and those responsible for the continuation of this process.

The major social, political and economic obstacles in the way of economic development of Pakistan are briefly: Illiteracy and conservatism of the masses, their religious orthodoxy and lack of desire

for material progress, their fatalistic attitude and a lack of spirit of adventure, their social customs and traditions preventing occupational mobility and the adoption of new techniques, their high marital fertility; the retardative effects of such social institutions as: purdah (veil), early marriage, joint family system, etc.; heavy defense expenditure; general political instability; corruption in government; absentee landlordism; shortage of coal and iron; shortage of capital; lack of technology; agricultural nature of the country's major exports and their great vulnerability to price fluctuations, etc.

Specific measures to overcome these obstacles have been discussed at some length in the study. Some of the general measures are: mass education and indoctrination of the people to desire progress; optimum utilization of the national resources; capital accumulation; limitation of population; state participation in the economic development of the country; gradual transfer of surplus population out of agriculture; and the introduction of new technology in the country.

An outline for the economic development of the country has been prepared in chapter VII of the study in which such estimates as capital requirements of the country, different sources of the needed capital, rate of transfer of population out of agriculture, length of time to double the current per capita real income, the required rate of growth, etc. have been worked out. At the conclusion of the analysis, the country turns out to have fairly good chances to double its per capita real income over the next two decades or so. It will, however, continue to be an agricultural country for quite some time to come. The industrialization may ultimately bring about an agricultural/non-agricultural population ratio of 40/60, which appears to be the limit under the present conditions. Maximization of agricultural production, simultaneously with the development of industries, especially small scale, is suggested as an economic policy for the country. The promotion of heavy industries at the expense of development in the agricultural sector, which seems to be the policy of the present government in Pakistan, has been concluded as short-sighted and unwise.

212 pages. \$2.65. MicA 55-80

MERCHANDISING FRESH FRYERS IN SERVICE MEAT DEPARTMENTS IN SUPERMARKETS

(Publication No. 10,586)

Arthur William Jasper, Ph.D.
Cornell University, 1954

From time to time, the broiler or fryer industry has experienced periods of relatively low returns and, in some instances, actual losses. Returns can be increased or losses reduced, depending on the general price structure, by any of several methods, namely: (1) cutting production, (2) increasing production efficiency, (3) more orderly marketing, and (4) by increasing consumption. This thesis deals with the latter approach.

To increase per capita consumption of fryers presents a challenge that should be met by all concerned with the fryer industry. Everyone who handles fryers in production, processing, or marketing, wholesale or retail, should take an interest in promoting fryers in an effort to increase consumption.

The effects of various merchandising and pricing practices on volume of fresh fryer sales were tested in the fall of 1953. The experiments were conducted in supermarkets with service-type meat departments, each of which was located in the business district of a different city in the Central New York Area.

In five experiments, four-by-four latin square experimental designs were used in testing the effects of different merchandising variables on volume of fresh fryer sales. Five-by-five latin squares were used in a sixth experiment to test price effects.

Each experiment was repeated twice.

Eviscerated, fresh, whole fryers were used as the standard treatment in all experiments. Sales from the various treatments, in each experiment, were compared with sales from the standard treatment. Sales were expressed in terms of pounds of fresh fryers sold per 100 customer units.

Results indicate that sales volume can be increased, over the standard, by using the following practices:

- a. Offering cut-up, whole fryers plus parts.
- b. Pre-packaging the cut-up, whole fryers in any type of transparent package, particularly cellophane.
- c. Adding an attractive, colored label to the package.
- d. Displaying attractively packaged fryers in a refrigerated aisle display table.

The magnitude of sales volume increased with each practice listed above (in the order given).

It was further learned that customers would select high-quality, eviscerated whole fryers at a ratio of six to one over standard quality whole fryers. In addition, volume was increased when high-quality fryers were offered at the same price as standard quality birds. Under the conditions of these tests, it appeared that customers were unwilling to increase their fryer purchases when a premium (3¢/lb.) was charged to cover the costs incurred in selecting and handling the higher quality birds. Quality differences were relatively slight, however, with the selection of

higher quality fryers based on complete freedom from defects and wider than average breast width.

Point-of-sale advertising in itself, or in conjunction with window advertising, materially increased sales of fresh, whole fryers. Window advertising alone had very little effect on sales volume.

By offering fresh, eviscerated whole fryers for sale at approximately 10 and 20 per cent above and 10 and 20 per cent below a standard competitive price, in addition to a standard price, it was determined that the price elasticity of demand for fresh fryers was relatively elastic, in the short run.

Based on a sample of 622 observed sales from the standard display, 12 per cent of the total weekly purchases of fresh fryers were made during the period Monday through Wednesday. Prior to this study, fryers had rarely if ever been on display in the experimental stores during the first three days of the week. This suggests that the offering of fresh fryers for sale in stores during the Monday through Wednesday period might well increase the total weekly sales volume.

184 pages. \$2.30. MicA 55-81

ALTERNATIVE ECONOMIC OPPORTUNITIES ON THE LAND FOR NEGRO VETERAN INSTITUTIONAL ON-THE-FARM TRAINEES IN THE GENERAL FARMING AREA OF NORTHWEST FLORIDA

(Publication No. 10,601)

Benjamin Luther Perry, Jr., Ph.D.
Cornell University, 1954

This study summarizes farming activities and financial progress for a group of Veteran Institutional On-The-Farm trainees. It represents an appraisal of this training program under a particular set of circumstances and from a particular point of view. The circumstances are those of Negro veteran trainees in a portion of Northwest Florida. The point of view is intended to represent an agricultural land economic approach in which economic progress forms the major basis for appraisal. This study was designed to re-examine in detail, under a particular set of circumstances, some of the issues touched on in a recent national study presented for public review in 1952 by the American Vocational Association. That study reached the general conclusion that, "the facts revealed show conclusively that the I-O-F training program opened the door of opportunity to thousands of veterans throughout the country and furnished 'know-how' which helped them become established in farming and in community life."¹ The study here is a far less ambitious undertaking than the American Vocational Association study in that it is restricted to a small group of veterans in Northwest Florida. It represents, however, an attempt to answer similar questions for this small group from a different approach.

The guiding thought has been that while the I-O-F program certainly "opened the door of opportunity to

thousands of veterans" there doubtless was much variability in the degrees of success actually attained. This idea was further intended to include the notion that this variability probably could be found to be related to the character of the land and other physical resources available to the veteran and to local institutional and sociological factors.

The effective universe consisted of a block of five counties in the northwest portion of Florida State Economic Area #3 and included 54 Negro trainees who qualified under certain restrictions set up for inclusion in the study. The physical resources on each individual farm were appraised and the farms placed into categorically generalized soil resource groupings having similar economic significance. Trainees were also classified according to tenure status. Degrees of success in the progressive establishment in farming were determined by studying the levels of financial progress attained on various quality soil resources over a period of four years.

Thirty-eight per cent of the trainees, who were enrolled in the I-O-F program in 1949, were classified as full-time operators in 1953-54, thirty-six per cent were classified as part-time operators, fifteen per cent were employed full time in non-farm jobs, and nine per cent had moved from the area. Sixty-one per cent of the trainees who began farming on high quality soil resources were full-time farming in 1954, thirty-nine per cent of the trainees located on the medium quality soil resources, and not any of those on the poor soil resources, were full-time farming in 1954.

The general conclusion is that unequal returns to comparable labor and management were received by trainees on the various quality soil resources. Percentagewise, successes were fewer for trainees on medium quality soil resources than on high quality soil resources. Only twenty-eight per cent of all the veterans included in this study may be considered as becoming permanently established in bona-fida full-time farming by 1954. The evidence collected suggests that successes in attempts to become established in farming on a sound economic footing are related to soil differences that can be identified ahead of time. A cartographic representation of farm classes according to geographically localized differences in the long-run income-expectancies for specific kinds of land use and farming practices would have rendered invaluable assistance to trainees in the selection of their farms and in the choice of alternative economic opportunities on the land, and would have helped the I-O-F training program in administering to the individual needs of veteran trainees. 384 pages. \$4.80. MicA 55-82

1. Education of Veterans in Farming, American Vocational Association, Inc., Washington, D. C., AVA Research Bulletin #5, 1953, p. 5.

ECONOMICS, COMMERCE-BUSINESS

A STUDY OF FUNCTIONAL RELATIONSHIPS IN DRUG STORE EXPENSE AND MARGIN

(Publication No. 10,448)

Frank Myron Bass, Jr., Ph.D.
University of Illinois, 1954

This study has as its objective the determination of the way in which percentage expense and percentage gross margin in drug stores vary with other variables. Expense and margin relationships are examined from three distinct points of view.

From one point of view one may attempt to "explain" the variation in percentage expense and percentage gross margin among several stores at a given time. The analysis revealed that the variation in product mix, or the proportion of total store sales in the prescription department, seemed to account for a considerable part of the variance in percentage gross margin. The three variables sales volume, percentage gross margin, and city size, all seem to be functionally related to percentage expense and are the variables which seem to "explain" the variation in percentage expense among several drug stores in a given year.

A second way of analyzing expense and margin relationships is by dividing the percentage expenses and percentage gross margins of a group of stores into quartiles in a given year and studying the behavior of the quartile averages with the passage of time. The analysis revealed that the percentage expenses and percentage gross margins of those stores farthest removed from the average in any given year tended, through time, to move closer to the average.

A third way of analyzing expense and margin relationships is by comparing their changes from one year to the next with changes in those variables which are thought to influence them. When changes in percentage gross margin from one year to the next were compared with changes in percentage of prescription sales, it was found that no general relationship existed, and, likewise, when changes in percentage expense and sales volume from one year to the next were analyzed, there was no apparent covariation between the variables. The reason for the absence of correlation between the variables probably can be traced to the fact that simple rather than multiple correlation was used and the fact that it was impossible to hold constant other dynamic elements such as changes in wages and prices. When changes in average drug store sales and average percentage expenses from one year to the next were compared, it was discovered that there seemed to be a lag relationship between the variables. There seems to be a tendency for average percentage expense to increase following years in which average drug store sales increase. Presumably this can be explained by the fact that the years when average dollar sales increase are the years when prices rise, the tendency for percentage expenses to increase in the years following the rise in prices being the result of general inflationary forces.

Although the limitations of the analyses should not be understated, it is believed that the methodological explorations and conclusions of this study contribute to a better understanding of retail relationships.

180 pages. \$2.25. Mic 55-1

CONSUMER BUYING HABITS IN SELECTED AREAS OF ST. LOUIS, MISSOURI

(Publication No. 9181)

Robert Lee Hurst, Ph.D.
University of Missouri, 1954

Advisor: Frank Miller

PURPOSE OF STUDY

This study was designed to learn: (1) where Negro families buy their food; (2) what factors influence their buying habits; (3) the type of foods purchased by families of different income levels; (4) variation in price and quality of products offered for sale in grocery stores, by type and location; and (5) nutritional adequacy of food purchases by cooperating families.

METHODS OF RESEARCH

A random sample of one hundred Negro families in metropolitan St. Louis was drawn to represent the area. From three to six consecutive weekly schedules showing were obtained from each family by personal interview.

SUMMARY

The food buying habits of the cooperating families varied considerably. The most important influencing factors were income, tenure status, size of family, nativity, type of stores patronized, and system of buying food.

Family income ranged from \$23.00 to \$220.00 weekly. The average family income was \$69.33 a week. The number of workers per family influenced income per worker. Workers per family averaged 1.21 for size two families, 1.44 for the average size family, and 3.50 for size ten families. As a rule, high income families spent more per capita on food than low income families.

Family sizes influenced buying habits. Large families spent more per family, but less per individual on food than small families. Types of food purchased by large families were somewhat different from that of small families.

Home tenure influenced families' food buying habits. Home owners received higher average incomes than other groups but spent less on food. Renters of unfurnished dwellings received less income than owners and spent more on food. Renters of furnished homes received less family income, but spent more per capita on food than the other tenure group.

Nativity of families influenced slightly the family's food buying habits. Families from southern states purchased somewhat different food from that of other nativity groups. However, these families were larger and their income was smaller than some other nativity groups.

The type of stores patronized influenced the type of food bought. Corporate chain stores had the lowest prices, extended the fewest retailing services, and stocked a fair quality of merchandise. Independent stores had the highest prices, extended more services including weekly credit, and stocked the least desirable quality of merchandise. Independent chain stores fell between the other two types in services rendered and prices of merchandise. However, the quality of merchandise in these stores was superior to that in either of the other two types.

System of buying influenced the prices for food. Families that bought their groceries on credit paid more for food than those who paid cash. Families who used both cash and credit had food expenditures between those who used the other two systems.

Adequacy of diet was measured by the Stiebeling standard. This standard outlines the foods that are contained in a low-cost and moderate-cost adequate diet. Foods purchased by the average family in this study met this standard with few exceptions. The average family bought only one third as much milk and twice as much meat as that suggested by the above standard. Thus it may be concluded that the average family in this study was adequately nourished.

236 pages. \$2.95. MicA 55-83

AN ANALYSIS AND EVALUATION OF THE GRAIN MARKETING SYSTEM IN SOUTHERN ILLINOIS

(Publication No. 10,543)

Clarence Peter Schumaier, Ph.D.
University of Illinois, 1954

This study is concerned with the grain marketing system and the markets for grain produced in the southern third of Illinois. It is based on the hypothesis that a successful grain marketing system must be adapted to the underlying conditions it faces.

Data for the study covering 1952 and 1953 was obtained from interviews with a stratified sample of 91 grain firms and from Census and Crop Reporting Service reports.

Grain production was more than twice as high in southern Illinois in the postwar years as in the pre-war period. A market had to be provided for an additional 50 million bushels of surplus grain after 1940. Grain sales per acre of farmland are still low however. Average grain volume per firm (about 300,000 bushels annually) is considerably smaller than in the remainder of the state.

About 12,121,000 bushels of storage space was available for country elevator operations. About one-fourth of this was available for commercial storage. The percent of available storage used by farmers

depended largely on whether the elevator accepted price support loan wheat.

Over half the corn and more than 90 percent of the wheat and soybeans sold to elevators were delivered in the harvest quarter of that crop. Corn and soybean sales in the state as a whole are much less seasonal than this.

Corn and wheat moved principally to St. Louis either for use there or reshipment to the South, Southeast and export. Soybeans moved to central Illinois processors.

Wheat and soybeans moved mainly by rail except within a radius of 60-70 miles of East St. Louis where trucking was important. In contrast, about half the corn was moved by truck and from all counties some trucking was done to East St. Louis or directly to the South.

The ready availability of truck transportation has widened the market for southern Illinois grain by providing a direct outlet to the South for corn and making barge transportation at East St. Louis available to a larger area.

In the postwar period about 50 new grain firms were established; most of them in areas with no elevator. In addition several redtop seed companies added bulk grain facilities. In this same period most of the small flour mills formerly important in the area ceased milling operations. They continued to buy grain but few give good service to farmers. Some have been salvaged by new owners.

Enough elevators have been built in the last 10 years to put one within 10 miles of most farmers in southern Illinois. They were adequate to handle the volume of grain offered in 1952-53 but only the northern counties and the areas around East St. Louis and Cairo have enough storage space to permit large-scale commercial storage operations. More space may not be justified, however, unless there is continued demand for price support loan wheat storage.

Three areas where improvements should lead to a better marketing system are suggested:

1. Work by elevator operators to increase volume by promoting programs aimed at increasing soil productivity.
2. More use of available elevator storage capacity.
3. Tightening of grain grading standards, particularly for soybeans.

Two possible educational programs are suggested:

1. Work with farmers explaining grain price seasonals.
2. Work with elevators on better use of storage space.

151 pages. \$1.89. MicA 55-84

ECONOMICS, FINANCE

BANK RESERVE REQUIREMENTS AND HOW THEIR EFFECTIVENESS AS AN INSTRUMENT OF MONETARY CONTROL MAY BE ENHANCED

(Publication No. 10,594)

John Livingston, Ph.D.
Cornell University, 1954

The maintenance of employment and real output at high levels is a major policy objective of the federal government of the United States. It has been recognized that if an essentially "free private capitalistic" economic system is to survive and flourish effective control of economic fluctuations becomes a necessity.

The purpose of this study is to examine one method of quantitative monetary control, the legal reserve requirement for member banks of the Federal Reserve System, with the objective of determining how that method of control can be made a more effective tool for combating undesirable economic fluctuations.

The study is divided into three parts to examine: first, the role of the present legal reserve requirement in the framework of monetary control; secondly, the historical development of legal reserve requirements in the United States from their original concept and form to their present concept and form; and, thirdly, the dissatisfactions expressed concerning the requirements and the plans set forth for their permanent reform.

Part One considers the role of monetary policy in the control of economic fluctuations and discusses the relative importance of the present legal reserve requirements as a method of monetary control. Not only the relationships of legal reserve requirements to the other methods of quantitative monetary control but, in addition, their relationships with other factors which also exert some influence on the size and composition of the money supply are examined.

Part Two in turn describes the development of the theory and the use of legal reserve requirements in monetary control. It is divided into three distinct periods. The first extends from the year 1781 to the year 1862, which was the period prior to the first federal legal reserve requirements. The second period extends from 1863 to 1913 the years of federal legal reserve requirements under the National Banking System. The final period extends from the passage of the Federal Reserve Act in 1913 to the present time. An attempt is made in this part of the study to analyze the development of the present legal reserve provisions and to determine the reasons for their inclusion in the existing requirement statutes.

Part Three describes the present problems concerning the legal reserve requirements for member banks of the Federal Reserve System. The criticisms of the existing provisions by credit authorities, economists, and operating bankers are set forth first. This is followed by an analysis of two plans of permanent reform of the statutory requirements presently being advocated. The plans are the 100 Per Cent Reserve Plan and the "Uniform Reserve Plan," a plan presented in 1948 to the Joint Committee on

the Economic Report by a committee of the Federal Reserve System.

The final chapter of the study contains a plan of proposed reform of the present reserve provisions for member banks of the Federal Reserve System. The plan is based on the conclusions drawn from this study. It is an attempt to enhance the effectiveness of the statutory reserve requirements in their major purpose, i.e., that of being an efficient tool of monetary control to be used by the monetary authorities in their effort to control undesirable economic fluctuations. Not only are the proposed reforms presented but, since any plan of reform cannot be divorced from its "practical" consequences, the transitional disturbances which would result from the adoption of the plan are also discussed.

315 pages. \$3.94. MicA 55-85

COMMUNIST MONEY AND BANKING: THE POLISH CASE

(Publication No. 10,520)

Bogdan Mieczkowski, Ph.D.
University of Illinois, 1954

This study seeks to confront Communist theory of money and banking with the actual experience of postwar Communist Poland, between 1945 and early 1954. For that purpose a dual approach suggested itself: First, a description of the Communist theory of money and banking; second, the analysis of relevant facts from the Polish experience.

The first chapter outlines aspects pertinent to the study: (1) the political character of the administration of a Communist country, (2) the chronological analysis of the postwar development of the Polish economy, (3) the institutional differences between the operation of the capitalist and the socialist economic system, and (4) the divergence between theoretical description and practical operation of the Communist economic system.

The second chapter characterizes the economic setting in which the Communist monetary and banking systems are called upon to work. The operation of the financial plan is briefly discussed, and the planned and controlling character of banking operations brought out.

The third chapter presents an outline of the Communist theory of money, based mainly on Russian authors. The discussion includes the role of Communist money, the use of the Equation of Exchange and its applicability, monetary circulation, and the functions of Communist money.

The fourth chapter describes the monetary developments in postwar Poland, tracing the causes and results of particular policies. It contains the discussion of the inflationary period 1945-1950, the monetary reform of 1950, subsequent inflation, and the advent of a new monetary policy in the spring of 1953.

The fifth chapter contains a description of the

Communist banking system and of the functions of particular banks. The treatment follows the functional lines of Communist banking organization: the creation of money, the clearing system, the use of short- and long-term credit, collection of savings, and management of foreign exchange operations. The subordination of banks to the Ministry of Finance, and the dominant role of the latter in the field of banking, is stressed. The chapter is based mainly on Russian sources.

The sixth chapter deals with the development of the Polish banking system into a tool serving the purposes of the centrally planned economy. Several stages in the evolution of Polish banking are distinguished, showing the progressive concentration of the banking structure in few banks with a clearly functional separation, and the growth of the control and planning element in banking operations.

The study is ended with concluding remarks on the parallelism and differences in the monetary and banking developments between Poland and the Soviet Union, on the relation between Communist theory and practice, and on the general trend of monetary and banking developments in Communist Poland.

The study stresses the importance of the institutional framework existing in Communist countries in the operation of the monetary and banking systems. Their functioning depends closely on the goals of the economic system and, influencing the course of economic events, is in turn circumscribed by them.

199 pages. \$2.49. MicA 55-86

THE EFFECTS OF FEDERAL FISCAL PROGRAMS ON ECONOMIC ACTIVITY

(Publication No. 10,560)

Charles John Van Dewater, Ph.D.
University of Illinois, 1954

The purpose of this study is to attempt to differentiate the quantitative effects of various types of Federal fiscal programs on two gross national product components: government purchases of goods and services and personal consumption expenditures. The former constitute the "direct" effects of programs on the level of economic activity. The effects of government programs on consumption are indirect or induced and depend upon the extent to which government programs affect disposable personal income. The end results of the study are expressed in terms of a system of fractional "weights" in terms of which the receipts and expenditures under various government programs may be translated from their actual or reported magnitudes to their "effective" magnitudes. The weights themselves represent the average amount of activity (as defined) associated with each given program divided by average expenditures or receipts under the given program for a particular historical base period (1946-50). The derivation and definition of the weights is discussed more fully below.

The study is carried out in four major parts, the

first of which consists in the derivation of a set of estimates of government receipts and expenditures. The basic set of estimates has the following characteristics: 1) receipts and expenditures are shown on a cash basis; 2) expenditures are classified by object; 3) the component items are adjusted to an "activity" basis and the timing of receipt and expenditure items is shifted to correspond as closely as possible with the economic activity associated with particular receipt and expenditure components. Data have been prepared on a monthly basis for the period 1940-1950.

The second step is the derivation of the effective magnitudes of fiscal programs consists in the estimation of the effects of receipts and expenditures on personal income. Government expenditures are translated into various types of personal income payments (e.g., wages and salaries, transfer payments, etc.). In the process, allowance is made for leakage out of government expenditures into business saving. Tax collections are assigned to persons in accordance with assumptions regarding the incidence of each major type of tax.

Each payment to or receipt from persons that is associated with government programs is then analysed in an effort to determine the amount of consumption that may be attributed to the income payment or tax collection in question. In making this analysis, payments to and receipts from persons deriving from government programs are allocated by income size groups; consumption associated with any particular payment (tax) is assumed to be dependent upon the distribution of that payment (tax) compared to the observed consumer behavior of persons in each income size class, as reflected in surveys of consumer income and expenditure patterns.

The estimates of the amount of consumption generated by income payments deriving from government programs and of the amount of consumption inhibited by tax collections from persons make it possible to compute consumption weights. The consumption associated with the total of income payments deriving from a given type of expenditure are divided by total expenditures under the program to obtain the relevant weight. In the case of government purchases, a "direct" effect of unity is added to the consumption weight. The consumption weights, it should be noted, reflect only the "first round" multiplier effects of expenditures and taxes.

The weights provide a means of evaluating the impact of various types of programs on activity. For the period covered by the study, 1940-50, the effects of expenditure programs generally outweighed those of taxes, even in the postwar period when tax collections exceeded expenditures. This suggests that, with due regard to the limitations imposed by the quantitative assumptions of the study, increased expenditures are a more potent stimulus than tax cuts.

211 pages. \$2.64. MicA 55-87

ECONOMICS, HISTORY

THE ECONOMICAL REFORM MOVEMENT IN ENGLAND, 1780-1788

(Publication No. 10,536)

Earl Aaron Reitan, Ph.D.
University of Illinois, 1954

The years 1780-1788 saw a number of reforms in the British administrative system. These reforms mark the beginning of a gradual transformation of the eighteenth century system into a machine suitable for the needs of the modern state. Although completion of this process was deferred until the nineteenth century, the investigation, debate, and legislation of the years 1780-1788 established a background of information and experience which set the tone for more successful reform later.

The economical reform movement began with Burke's speech on economical reform in 1780, primarily as an attack on the political system of George III. The Rockingham Whigs saw in the pensions, places, and uncontrolled expenditure of the Civil List the chief source of that "influence" which had kept them out of office. In his plan of reform Burke extended his vision to include many other abuses in the administrative system. Finally the disasters of the American War brought the North ministry to its fall, and this phase of the economical reform movement culminated in Burke's Civil List Act of 1782. The Rockingham Whigs were not at heart reformers, and Burke's bill was much less extensive than the plan of reform which he had presented in 1780.

The principal leadership in economical reform came from elsewhere. In 1780 Lord North had led in appointing the Commissioners of Public Accounts, whose fifteen reports from 1780-1787 became the backbone of the economical reform movement. Virtually all important reform legislation of this period was based directly on the reports of the Commissioners. One objective of the thesis is to relate the reform legislation of the period to the reports of the Commissioners. The most important single individual was the Earl of Shelburne, in whose short-lived ministry the groundwork was laid for the reforms of Pitt. Another contribution of this thesis is a study of the extensive work of the Shelburne ministry, a study based on the Shelburne papers at the Clements Library, Ann Arbor, Michigan. Pitt is treated as the heir of Shelburne and the Commissioners of Public Accounts, and his measures of reform are shown to stem directly from the process of investigation and debate of the years 1780-1784. Throughout the thesis the continuity of the economical reform movement is stressed.

In the working out of the economical reform movement, three underlying objectives are noted. One objective was the retrenchment of expenditure and prevention of waste. In the first years this objective was conditioned largely by the experience of a costly and ill-managed war; under William Pitt the objective was to secure a surplus for debt reduction. Civil service reform also received attention, and the modern

concept of a professional civil service was stated in opposition to the eighteenth century concept of office as a private property. A third basic objective of the economical reform movement was the establishment of better control over the handling and expenditure of public money. Control of the public accountants, better method of account and audit, centralization of responsibility for finance in the Treasury, and better information to Parliament received attention. The legislation of the years 1780-1788 was largely ineffectual in achieving these ends, but a background of information and experience was gained which prepared the way for the work of Parnell, Huskisson, and Peel.

309 pages. \$3.86. MicA 55-88

FEDERAL FINANCE AND THE AMERICAN ECONOMY, 1790-1860

(Publication No. 9451)

Paul Barton Trescott, Ph.D.
Princeton University, 1954

This study re-examines federal debt, monetary, tariff, tax, and land-sale policies during 1790-1860, using new statistical series covering all aspects of federal finance. For the first time, data were compiled integrating all the financial transactions of the federal government, showing expenditures by function, receipts by source, and receipts and expenditures by economic class.

The substantive functions of the government took shape prior to 1820; thereafter they were marked by growth rather than diversification. Nearly half of total expenditures went for defense, with general government and interest following in importance. The tariff furnished five-sixths of net federal revenue. Net federal expenditures reached a maximum of \$80 millions, but were usually only 2-5% of national income.

Because customs revenues were sensitive to business fluctuations, deficits occurred in each major depression of the period — 1819-21, 1837-43, and 1857-9 — financed by non-deflationary borrowing or near-monetary Treasury notes. Federal officials experimented with various *ad hoc* measures for depression assistance, particularly, after 1848, buying federal securities in the open market, thus adding to bank specie reserves. By 1860, Treasury officials well understood the possibilities of using government finance to combat depressions, but held back from advocating such actions on Constitutional grounds.

However, federal finance during boom periods frequently contributed to over-expanded imports and bank credit, helping to bring on crises. Tariff reductions were a factor in all three major crises, while easy credit was promoted by federal actions in 1816-8 and 1834-6. Federal policies helped touch off the monetary crises of 1818 and 1837.

Federal finance had its greatest effect on short-run business conditions during the War of 1812. Large deficits financed out of new bank credit or

Treasury notes caused substantial inflation. But the incompetence of the financial program and the actual extent of inflation have been exaggerated. Furthermore, much of the attendant economic derangement resulted from the disturbed state of international trade.

The banking system was a major factor in economic instability. In 1816, the Second Bank of the U. S. was chartered to end the wartime monetary disorder. Unfortunately, it was unable to restore specie payments without monetary contraction, and its conduct in 1817-20 cost it dearly in public esteem. During the 1820's Nicholas Biddle began to develop the stabilizing techniques of the Bank. But Jackson's successful campaign to destroy the Bank condemned the economy to eighty years of violently unstable decentralized banking. After 1846, the Independent Treasury did provide some stabilizing force by its tendency to absorb specie in boom times and release it during slumps.

The most striking long-run aspect of federal finance down to 1836 was the consistent use of tariff revenues to retire debts incurred during the Revolution and the War of 1812. From a peak of \$127 millions in 1815, the debt was all paid off by 1836 (although it soon reappeared). This constituted a process of 'forced saving' — funds spent for consumption of imports were diverted into the capital market, and usually into productive investment. The tariff provided some encouragement to manufacturing development, particularly in later years. Down to 1840, federal finance contributed about \$150 millions to capital formation, a contribution comparable in magnitude to that of bank credit or of capital importations. Total capital formation down to 1840 was about \$3 billions.

However, federal finance tended to accentuate inequality of incomes and wealth, a tendency evident in Hamilton's program. Funding the debt and establishing the Bank stimulated capital investment, but yielded large benefits to the wealthy merchant and speculators who held most of the public debt.

575 pages. \$7.19. MicA 55-89

ECONOMICS, THEORY

AN ANALYSIS OF THE PRODUCTION RELATIONS OF A MEDIUM SIZE MANUFACTURING PLANT

(Publication No. 10,581)

Kalman Goldberg, Ph.D.
Cornell University, 1954

This study is an attempt to test whether:

1. the Cobb-Douglas production function ($P = bL^kC^j$) describes the relationship between output (P), and labor (L) and capital (C) in a medium size manufacturing plant for the period 1917-1941.
2. if the first hypothesis is correct the k value in

the equation accords with the share of value added that actually went to labor on a year-to-year basis and for the period as a whole as would be expected if the marginal productivity theory of distribution along the Cobb-Douglas lines is valid.

P is deflated value added, L is man-hours and C is capital available, book value, deflated. The period studied embraces many years of less than full capacity production. Therefore to test the first hypothesis two estimates of capital utilized were attempted. The first related capital in use to fluctuations in man-hours and time; the second to man-hours and the rate of introduction of new machinery. Both estimates are subject to the criticism that C loses its independence, fluctuating in relation to man-hours.

The Cobb-Douglas equation was converted into logarithmic form and solved by the method of least squares with the use of P, L and each C series. A further test of the first hypothesis was the introduction of an incremental formula in which it was hypothesized that changes in output are related to changes in labor and capital such that $P = a + b\Delta L + d\Delta C$. The values of the unknowns are as follows:

	<u>b</u>	<u>k</u>	<u>j</u>
1. When C is capital available	.05	1.49	.18
2. When C is estimated as related to man-hours and time	.11	1.28	.21
3. When C is estimated as related to man-hours and the rate of introduction of new machinery	.10	1.08	.41
4. Incremental formula	142.0	1.11	-.52

All tests resulted in good fits, the coefficient of correlation exceeding plus .90 in each case although the incremental formula on a year-to-year basis was not as good as the Cobb-Douglas type.

The goodness of fit in all cases is partially explained on the basis of the overwhelming importance of the man-hours input and the close relationship this series bears to the volume of output. This is particularly true of the solutions with the capital utilized series since fluctuations in capital were tied to fluctuations in man-hours.

The greatest discrepancy between these findings and those of Douglas lies in the k and j values. In almost all the Douglas cases they total to unity whereas in this study all cases exceed unity due, probably, to an exaggeration of the man-hours input when "overhead" labor existed during the 1930's, the distorting effect of unutilized capacity not properly corrected and, although it is not ascertainable, perhaps to increasing returns to scale.

Regarding the second hypothesis there was no relationship between the appropriate k value (1.49, capital available series) and the actual share of product that went to labor either on a year-to-year basis or for the period as a whole.

This discrepancy is explained as follows:

1. The Cobb-Douglas formulation assumes an invariant production function. This precludes any correlation between the actual and theoretical shares on a yearly basis insofar as the actual function was variable.

2. The absence of pure competition results in wage payments based on the marginal revenue product and this is always less than the value of the marginal product.

3. The disparity between long-run decisions by the firm when some degree of substitution is possible and the marginal productivity of a factor may be significant and short-run distribution decisions when the opposite is true also partially accounts for the discrepancy.

267 pages. \$3.34. MicA 55-90

EDUCATION

EDUCATION, GENERAL

A SURVEY OF THE EFFECTS OF THE MISSOURI SCHOOL DISTRICT REORGANIZATION LAW OF 1948 UPON THE HIGH SCHOOL PROGRAM

(Publication No. 10,100)

Lyle Galen Bounous, Ed.D.
University of Missouri, 1954

PURPOSE: The purpose of this investigation was to determine the extent of the changes in the curricular programs of public high schools in reorganized districts in Missouri since the state School District Reorganization law became operative July 18, 1948.

METHOD OF RESEARCH: Such information as pertained to the year 1947-48 was obtained from bound volumes of Form A, entitled Application for Classification and Annual Report of Superintendent to the State Board of Education, located in the permanent files of the State Department of Education of Missouri in Jefferson City. Information pertinent to the year 1953-54 was gathered from similar forms in the files of the Missouri District Supervisors of Public Schools, in some cases by correspondence, in other cases by personal transcription.

For purposes of comparison the high school districts involved in this study were categorized as follows: First, the 26 districts having lost their former identity through absorption by other districts; second, the 19 absorbing districts; third, the 181 districts not involved in mergers of old districts; and fourth, the second and third groups collectively, that is, the 200 reorganized high school districts constituting the index upon which this dissertation was based.

SUMMARY: (1) The greatest increases in the incidence of offering of specific courses in the 200 reorganized high school districts were noted in Spanish I, Spanish II, School Publications, Dramatics, Public Speaking, Sociology, Missouri History, Psychology, Family Relations, Advanced Mathematics, General Biology, Chemistry, Art I, Art II, Band, Secretarial Practice I, Shorthand I, General Business, Bookkeeping I, Typing II, Vocational Agriculture I-IV, General Home Economics I-IV, Vocational Home Economics I-IV, Related Home Economics Art, General Drafting I, General Woodworking I, General Shop I, Drivers Training, and Health.

(2) The greatest decreases in the incidence of offering of specific courses were noted in Advanced

Algebra, Physiology, Orchestra, General Agriculture I, and Related Home Economics Science.

(3) The mean number of specific courses available to students of the 26 absorbed high schools in 1947-48 was 22.0; in 1953-54, it was 35.8, an increase of 62.7 per cent.

(4) The mean number of specific courses available to students of the 19 absorbing reorganized high schools in 1947-48 was 27.2; in 1953-54, it was 35.8, an increase of 31.6 per cent.

(5) In the 181 reorganized high schools not involved in district mergers the mean number of courses available to students rose from 27.6 in 1947-48 to 33.0 in 1953-54, an increase of 19.6 per cent.

(6) In the 200 reorganized high schools taken as a whole, the mean number of courses available to students rose from 27.5 in 1947-48 to 33.2 in 1953-54, an increase of 20.7 per cent.

CONCLUSIONS: (1) Reorganization without consolidation appears to be of little avail, curricularly.

(2) There appears to be a trend toward practical arts and vocational courses and/or courses of a socializing nature.

(3) The trend in the vocational area is toward course-titles of general, rather than specific, character.

(4) Contrary to popular opinion, the incidence of offering of fundamental science courses is increasing, rather than decreasing.

RECOMMENDATIONS: (1) Since most reorganized high school districts are still too small to provide an adequate program, it seems advisable to continue to establish larger districts by consolidation of smaller districts.

(2) Inasmuch as the consolidation of districts does not necessarily imply larger high schools and broader programs, school district reorganization should continue to establish larger high schools by consolidation of smaller high schools.

(3) The State Department of Education should endeavor to establish, as soon as possible, uniformity and consistency in course-title terminology in all its forms and publications, as well as in written communications.

155 pages. \$1.94. MicA 55-91

THE ACTIVITIES AND BACKGROUNDS OF PUPILS WITH DOMINANT SCIENCE INTERESTS

(Publication No. 10,102)

Galen William Bull, Ed.D.
University of Missouri, 1954

Supervisor: Ralph K. Watkins

Purpose: The purpose of this study was to analyze the backgrounds and activities of high school pupils who showed some unusual interest or activity in some phase or application of science during the time of their enrollment in science classes, and to determine in so far as possible what the conditioning experiences were that seemed to be instrumental in the development of a science interest or hobby.

Method of Research: Case history studies were made of one hundred high school pupils having dominant science interests and hobbies and who were recommended by their science teachers. The method for obtaining the case histories was by personal interview of each pupil.

Summary and Conclusions:

1. Most pupils having dominant science interests and hobbies will develop these interests at an early age, and the beginning of science hobbies will follow the interest development.
2. The large majority of pupils with dominant science interests and hobbies are superior in scholastic ability to the normal pupil in the same schools.
3. Three-fourths of the pupils with dominant science interests and hobbies have a preference for interests and hobbies involving physical science.
4. Nearly all pupils with dominant science interests and hobbies tend to have good social poise and are not classified as unusual in social behavior.
5. Approximately 60 per cent of the pupils with dominant science interests and hobbies are inclined to avoid the usual physical activities found in the typical secondary school.
6. Most pupils with dominant science interests and hobbies seem to be willing to devote most of their spare time to their interests and hobbies rather than to activities considered usual for adolescents.
7. Nearly 100 per cent of the pupils with dominant science interests and hobbies exhibit keen curiosity about the working of scientific apparatus.
8. All the pupils with dominant science interests and hobbies are readers of science literature.
9. Pupils with dominant science interests and hobbies are encouraged by parents or science teachers in their interests and hobbies.

Recommendations:

1. There should be a program of science in the elementary grades which emphasizes wide reading, activities, and science hobbies as the basis for development of science interests in normal children since this study shows that science interests begin before or during junior high school.
2. Reference materials, science books, and

periodical literature should be made available to pupils in school libraries, as science reading seems to intensify pupils' interests in science.

3. Science teachers should make an effort to recognize and encourage pupils with dominant science interests and hobbies.

4. Since pupils with dominant science interests and hobbies may be the science teachers and the scientists of the future, the vocational opportunities in science should be presented to the pupils for their information and for their guidance.

366 pages. \$4.58. MicA 55-92

THE DEVELOPMENT OF PROCEDURES AND MATERIALS FOR STUDY AND REVISION OF THE SCIENCE CURRICULUM IN SECONDARY SCHOOLS

(Publication No. 10,456)

Charles Elton Burleson, Ed.D.
University of Illinois, 1954

The central purpose of this study in the science area of the secondary school curriculum was that of developing printed instruments and designing procedures which would assist any school-community group to study and analyze the adequacy of their science program and to assist them in working out plans for improvement. The study was also concerned with the development of a set of proposed objectives for the science program of the school which served as the basis for the design and construction of the instruments.

Underlying the development of the study were three basic assumptions: (1) curriculum change can best be accomplished through orderly and planned means, (2) the building of consensus with respect to an ideal picture of a particular school program is essential in defining the direction of change, and (3) that the instruments and procedures would function to afford consultant-type services by: (a) promoting the involvement of a representation of all those serving and served by the school in curriculum planning, (b) establishing channels and techniques of communication, (c) helping the group define and clarify its goals, (d) aiding the group in an appraisal of the current performance of the school, (e) aiding the group to select competent school personnel to formulate suggested plans, and (f) helping the planning group to work out concrete plans for improvement.

The design of the study was based on a conceptual theory of curriculum development and revision which was described in terms of a systematic and democratic process.

The printed instruments were structured around thirty-two objectives formulated by a study of the literature, a process of jury consensus, and trial runs in local schools. The instruments were so patterned that a local school-community group of teachers, administrators, parents, non-parents, and students might use them to determine local opinion

regarding these objectives, to promote knowledge and understanding of them through full and free discussion, to designate specific aspects of the local science program that appeared to be in need of improvement, and to assist with the development of a local plan for making these desired improvements.

The writer recommended to the Illinois Secondary School Curriculum Program, the sponsoring organization for this study, that consideration be given to (1) further improving and refining the instruments and procedures by utilizing data derived from schools where the study has been undertaken; (2) determining the degree to which the success or failure of the procedures is directly dependent upon local leadership at the various levels of responsibility; and (3) determining whether the procedures and instruments developed in this study structures a curriculum planning situation too highly or whether there is so little structure that effective planning does not take place.

207 pages. \$2.59. MicA 55-93

THE DEVELOPMENT AND APPRAISAL OF MATERIALS AND PROCEDURES FOR BUILDING PARENT-TEACHER CONSENSUS REGARDING COOPERATIVE SCHOOL IMPROVEMENT

(Publication No. 10,472)

Gordon Wesley Fielder, Jr., Ed.D.
University of Illinois, 1954

One indication of the need for increased parent-teacher cooperation is provided by an investigation that shows that the adaptability of schools to the new educational technique is a lengthy process, and that where the layman is involved, adaptability is thereby increased. Another investigator establishes the need for increased cooperation by determining that there often is a significant difference between what educators think the community wants the school to do and what the community actually wants in the way of an educational program. The fact that several investigators conclude that the National Congress of Parents and Teachers largely fails in providing this cooperation is additional evidence of this need.

The problem of the project reported in this study was to develop materials and procedures that would show reasonable promise of meeting this need by helping parents and teachers to improve their cooperative relationships. In developing these materials, the viewpoint that educational change involves changing the relationships of people by modifying their perceptions of the behavior expected of others was accepted as a part of the problem.

The way in which these perceptions may be modified was seen to be a disciplined form of discussion that has as a goal consensus regarding the three problems common to all, or nearly all, schools. These problems are:

1. To decide what aspects of the school enterprise should be of mutual concern to parents and teachers.

2. To select from the aspects of the school accepted as being of mutual concern those that are to serve as objects for increased cooperation.

3. To decide how to organize for more effective cooperation in the improvement of the aspects of the school selected as objects of cooperation.

The project was known as the Parent-Teacher Cooperation Study and was sponsored by the Illinois Curriculum Program. The materials and procedures making up the study were designed to provide any group of parents and teachers with assistance in reaching agreement concerning the above problems. These materials consisted of three printed instruments known as Inventories A, B, and C. Inventory A, What Kinds of Parent-Teacher Cooperation Should We Strengthen in Our School?, contains a series of sixteen questions and eleven illustrations that relate to parent-teacher cooperation regarding specific aspects of the school enterprise. The purpose of this instrument is to solicit opinions that would serve to induce parent-teacher discussion.

Inventory B, What Kinds of Parent-Teacher Cooperation Should We Strengthen in Our School?, along with Inventory A, was designed to enable parents and teachers to resolve the first two problems noted above. This instrument repeats the questions and illustrations in Inventory A. Administered at the conclusion of discussion based on the results of that instrument, Inventory B records the decisions of the parents and teachers regarding the first two problems as those decisions may have been affected by discussion.

Inventory C, How Can Parents and Teachers Organize to Improve the School's Program?, was designed to help resolve the third problem. This instrument enables the parents and teachers to indicate the ways in which they would like to organize in order to improve their cooperative relationships. The results produced by this instrument will provide a planning committee with information it will need in order to develop a plan for improved and continuing parent-teacher cooperation.

The first school to use the Parent-Teacher Cooperation Study did so on a pilot study basis. An appraisal of the pilot study as it was conducted in this school revealed that these materials and procedures showed satisfactory promise of enabling parents and teachers to improve their cooperative relationships.

166 pages. \$2.08. MicA 55-94

A STUDY OF HIGH SCHOOL SCIENCE COURSES IN GRADES 9-12 DESIGNED FOR GENERAL EDUCATION

(Publication No. 10,580)

Norman Anthony Flannigan, Ph.D.
Cornell University, 1954

The Purpose

The purposes of this investigation are (1) to give a current picture of the status of general education

science in the public high schools of the United States, grades 9-12, through study of (a) the place of general education science in the curricula of sample schools, (b) the methods used in teaching such courses, (c) the methods of selection of content and (d) an evaluation of the general education science objectives of the schools in which such courses are taught; and (2) to show how these general education science courses compare in the above areas with the usual conventional science courses: general science, general biology, elementary chemistry and elementary physics, presently taught in the same sample high schools.

Procedure

It was decided to use a random sample of 800 public high schools across the nation. The size (enrollment), type and geographical location of these schools was determined from the Statistics of Public High Schools. Their names and addresses were obtained from Commissioners in the state departments of education in the various states. A double post card was sent to the principals of these schools asking their cooperation in the inquiry if a course, or courses, in science was taught in their school other than the conventional four science courses. Checklists were sent to principals who agreed to cooperate. This checklist called for data on each course taught and was divided into three parts.

Part one was made up of two sections, the first having reference to the four conventional science courses and the second, to all science courses other than these four. Many questions in both sections were identical for comparative reasons: however, there were many more questions in section two and treatment was much more extensive since the section pertained to general education science courses.

Part two of the checklist contained a list of 40 general education science objectives directly related to the secondary school. Instructors were asked to evaluate these on a numerical basis for each of the science courses taught other than the conventional courses.

Part three also was divided into two sections. In the first were listed methods of teaching general education science courses more commonly used in high schools. Instructors were asked to identify the method, or methods, used in each course taught. The second section of part three dealt with those factors that may have helped the instructor to determine the content of a particular science course.

Of the 800 schools in the random sample, the final number that returned completed checklists acceptable as far as general education science was concerned was 117, in which 216 courses were reported, representing 47 different types.

Some Major Findings

On the basis of information supplied by the 117 schools via the checklists, the following conclusions have been drawn:

1. General education science courses, especially those used to replace the conventional courses in chemistry and physics, are increasing in the public high schools. This is obvious from the starting dates

of courses mentioned and from change in enrollment in the courses.

2. Educators are increasingly prone to realize the value of general education science for the non-scientist.

3. Few schools refuse to allow such general education courses to be used toward a science major or to fulfill a science requirement for graduation. Schools in general seem to be seeking courses to replace conventional science courses and are placing such courses on equal footing.

4. The great majority of these courses are developed for the junior and senior years. This would seem to indicate that many schools are fairly well satisfied with freshman general science and sophomore general biology but are trying to form a four-year science sequence in terms of general education. However, a considerable number of these courses enroll sophomores, indicating that general biology as a sophomore subject has not been nationally accepted.

5. Laboratory work is included in three of every four of the general education courses studied. In seven of every ten of these laboratory courses, the students are required to work individually or in pairs.

6. Checklist data show that more than six of every ten general education science courses are accepted by colleges for entrance credit.

7. Principals prefer men teachers over women for their general education science courses, in a ratio of about seven to three.

8. General education science courses are not considered courses for the slow learner. Only about three per cent of the sample courses are used for this purpose.

9. The most generally accepted objective of general education science according to checklist reports is to present a broad, integrated understanding of science which should directly contribute to scientific method and critical thinking.

10. The subject-matter survey course is still the most popular means of presenting general education science material in the secondary school.

11. One of the commonest methods for selecting content for general education science courses is to choose a textbook which conforms closely to the objectives of the course.

210 pages. \$2.63. MicA 55-95

A STUDY OF THOSE EXTRA-CURRICULAR ACTIVITIES WHICH CONTRIBUTE TO NATURE AND CONSERVATION EDUCATION IN CERTAIN LIBERAL ARTS COLLEGES

(Publication No. 10,584)

John Alfred Gustafson, Ph.D.
Cornell University, 1954

It is widely recognized that conservation education and nature education are intimately associated. Those

attitudes which are basic to good conservation practices are largely based on the degree of appreciation and understanding which the individual has for the natural world. On the college level such appreciation is rarely gained through formal course work in the natural sciences, but may be gained through certain extra-curricular activities if these are properly administered and set up. Furthermore, it is held that a liberally educated person is one who is acquainted with the natural world, knows his place in it, and is cognizant of the need for its conservation.

This study describes in detail the outdoor extra-curricular programs at Dartmouth College, Hanover, N. H. and Bowdoin College, Brunswick, Maine. The career and methods of Professor William G. Vinal of the University of Massachusetts are described as an illustration of an effective personal approach to conservation and nature education.

The Dartmouth outdoor extra-curricular program is well-developed, with a continuous history since 1909. The principal effort has been through the Dartmouth Outing Club. Through the years special outdoor interest groups have been organized, often within the Outing Club. These include a canoe club, hunting and fishing clubs, mountaineering (rock-climbing) club, riding club, natural history club, and ski clubs and teams. Outside of the Outing Club outdoor nature education has been fostered through the College Museum and the Office of the College Naturalist.

The College Naturalist (or Naturalist-in-Residence) program was a unique experiment in outdoor nature education. The College Naturalist, first hired in 1938, was given no teaching responsibilities, but was to coordinate under-graduate enthusiasm for nature study through a strictly extra-curricular program. The program was largely successful, although it was discontinued in 1951. It had great potential for nature and conservation education.

At Bowdoin there has never been an outdoor extra-curricular program with the wide appeal of that at Dartmouth. However, two unique developments, the Kent Island Scientific Station and the Bowdoin-MacMillan arctic work, are noteworthy.

Professor William G. Vinal, known to many as "Cap'n Bill", has, through his gifted teaching and warm personality, inspired hundreds of his students to follow careers in nature recreation.

Questionnaires dealing with the Dartmouth and Bowdoin programs were submitted to samples of alumni, faculty, administrative personnel, and students. Professor Vinal's former students were asked to evaluate his teaching. Quantitative data wherever appropriate were gleaned from these returns. In other cases, opinions were simply quoted and/or analyzed. The overwhelming majority of the sample groups were satisfied with the programs under study, and nearly 100% of those queried about him approved of Professor Vinal's methods. However, there were suggestions for improvement, especially of the Dartmouth program, which has been under scrutiny by Dartmouth men particularly during the past fifteen years. The principal criticism is that the clubs sponsoring these activities tend to become "in-bred",

with a narrow program and a narrow appeal. Recommendations for broadening the base of participation and for increasing the scope of the program were made.

A brief survey of the outdoor extra-curricular programs as they exist in eighty-three liberal arts colleges show that, although many colleges are situated in areas suitable for outdoor activities, there is tremendous opportunity for the development of programs designed to instill appreciation of nature and instruct in conservation practices.

If college students are to acquire the "conservation ethic", as Aldo Leopold put it, then the colleges must use all the facilities available to them which are suited for the job. Classroom instruction, by its very nature, can contribute little. Intimate contact with the out-of-doors, competent instruction in natural history, and the choicest esthetic experiences, coupled with the relaxing and re-creating qualities of outdoor living, constitute the best means by which college students may acquire a conservation conscience.

In the light of this information and belief suggestions for a program of extra-curricular nature education in the liberal arts college were formulated.

491 pages. \$6.14. MicA 55-96

THE DEVELOPMENT OF AN INSTRUMENT TO MEASURE AN ASPECT OF CRITICAL THINKING IN THE AREA OF HIGH SCHOOL CHEMISTRY

(Publication No. 10,513)

Herbert John Max, Ed.D.
University of Illinois, 1954

The study deals with the development of an instrument to measure the ability to interpret data in the area of high school chemistry. This ability is an aspect of critical thinking which has been for many years a learning objective of high school chemistry courses.

Critical thinking has been defined in many ways, but the ability to interpret data seems to be a part of most concepts of critical thinking. Also ability to interpret data is essential to the chemist and the scientist as well as to the average citizen. There is an abundance of data in the chemical literature, and so the ability to interpret data was chosen for the purpose of this study.

The behavior aspects of those who have the ability to interpret data were established from a survey of the literature. The two major aspects, the ability to perceive relationships in the data and the ability to recognize the limitations of the data, were chosen as the criteria in selecting problems and developing items. The problems consisted of chemical data. The method of response selected was that each statement must be judged as true, probably true, insufficient evidence, probably false or false.

The first draft of the instrument was submitted to

22 high school students using an oral problem solving technique. Taking the results from this procedure the problems and the items were revised. They were then divided into two separate tests, each with four problems and approximately the same number of items, for convenience in administering. These were given to high school chemistry students. With Form I, 114 completed answer sheets were obtained and with Form II there were 124. An item analysis was then made. In the process a discrimination index and a difficulty level for each item were obtained and the items were examined for reading and vocabulary difficulties and possible misinterpretations. Finally test I was reduced to 41 items and test II to 44 items. Using the total general accuracy scores and the Kuder-Richardson Formula 20, the reliability coefficients obtained were .74 on Form I₄₁ and .76 on Form II₄₄. Applying the Spearman-Brown prophecy formula a coefficient of .85 was obtained for I₄₁ and .87 for II₄₄ when the tests are doubled in length.

Subscores were also obtained for groupings on the basis of responses and also on the basis of errors. The responses were divided into three groups, TF, PTPF, and IE. The errors were also divided into three groups. These were beyond data, caution, and crude error. The reliabilities on these subscores were lower than on the general accuracy scores.

It was shown that the value of the reliability coefficients could possibly be affected by the fact that in all groups, knowledge learned in chemistry influenced some answers but played no part in others. Also the reliability could be increased by doubling the length of the tests. However, in order to put them into immediate use both forms of the test could be given and the scores compared. If the extremes showed consistency on both forms, these scores could then be regarded as being quite reliable. Scores obtained on the non-extreme individuals may be used together with information from other sources for purposes of making decisions about individual students. Group scores may be used for directing teaching methods and revising teaching procedures.

98 pages. \$1.23. MicA 55-97

IDENTIFICATION OF MAJOR NEEDS OF VERMONT YOUTH IN HIGH SCHOOL GRADES 10, 11, AND 12

(Publication No. 10,434)

Burton Howard Peake, Ph.D.
University of Connecticut, 1954

Statement of the Problem and Purpose of the Study

There is a constant challenge to school administrators and teachers to develop and maintain an effective curriculum which meets the needs of all youth in our secondary schools. Individual and group guidance techniques are essential activities within the modern curriculum which is directed toward assisting the individual to live more effectively in his environment.

Vermont school administrators indicated their desire for guidance in obtaining evidence of personal and educational needs of youth in Vermont High Schools which were more clearly defined and understood. These data seemed necessary and basic to professional and lay groups who were attempting to understand the needs of youth to be considered in reaching decisions for sound revision of the curriculum in Vermont communities.

This study was made for the purpose of identifying needs of Vermont youth in High School as an aid to the State Department of Education Committee on curriculum revision and as a guide for Vermont High Schools in their attempt to identify and understand needs of youth which could be met through staff study and planning of the curriculum.

The Imperative Needs of Youth as stated in Planning for American Youth published by the National Association of Secondary School Principals, Washington, D.C. 1944 were adapted for use as a criterion for this study. Agreement at the State Department of Education level that the stated Imperative Needs were probable needs of Vermont Youth in High School required verification.

Method of the Study

Verification was made by using a three-way approach to identification of youth needs. Seven communities representative of the state geographically were selected as samples for the identification of needs by, (a) providing a way for youth in high school grades 10, 11 and 12 to state their problems as they felt them, (b) providing the parents of these youth a way to express their agreement or disagreement that the youth needs as stated in the criterion were, in fact, the needs of youth in school as they understood them, and (c) providing a way for recent graduates of these schools to express in retrospect their reaction to the help received while in school in meeting selected needs. The reactions to prepared statements submitted to these three groups were then related to the criterion of the imperative needs. The writer considers the three-fold approach for identifying needs of youth to be unique.

The Mooney Problem Check List was selected as the instrument which could best be used by youth in school to express their personal problems as they understood them. This check list provided a wide range of 330 common problems of youth in eleven areas which were closely related to the needs of youth as previously stated. The writer followed a standard procedure in each school to obtain a free expression of youth problems.

The parents of these youth expressed their opinion on a scale providing four degrees of reaction to each of the imperative needs with implementations of each need designed to show whether parents would say the same thing for the implementation as they would for the "need". Freely written comments were encouraged at the end of each of the ten check lists. For the purpose of this study, the amount of definite agreement among parents was considered essential. The third part of the study was designed

to obtain from recent graduates an evaluation of secondary school experience in retrospect.

Findings of the Study

One-hundred and twenty-eight major problems of the youth in High School Grades 10, 11 and 12 were identified and related to the imperative needs criterion. A major problem is one identified as a personal problem by one youth in six, or by 17 percent or more in each grade. Discussion groups, each having a common major problem and numbering from ten to sixty members, are clearly identified. The major problems group provides a priority guide to the school staff in planning curriculum revision to meet the needs of youth in High School.

The range of agreement among parents that the Imperative Needs Criterion as presented to them were in fact needs of youth in school was from 64 percent to complete agreement, with a mean of 82 percent definite agreement. There is substantial agreement among the parents of the youth in school that the imperative needs criterion are acceptable to them as needs to be met by Vermont High Schools.

The appraisal of help received by former students in the same seven high schools selected for this study as stated in their reaction to eighteen major problem areas, ranged from 11 percent agreement that they were "helped a great deal" on "Marriage and Family Life" to 59 percent that they were "helped a great deal" in "getting along with other people". The former students responded to a scale of four degrees of reaction; "helped a great deal", "helped some", "helped little or none", "uncertain". These expressions of reaction were related to each of the ten imperative needs.

Recommendations

The writer recommends that committees be created at the state and local levels for the further study of facilities, materials, methods and teaching techniques which would seem to meet the needs of Vermont Youth as found in this study. The findings of this study can be used as a guide for such committees in developing goals, improvements and implementations for meeting "needs" of Vermont Youth in High School.

265 pages. \$3.31. MicA 55-98

A MANUAL OF RETAIL SALESMANSHIP

(Publication No. 6311)

Willard Mead Thompson, Ed.D.
New York University, 1953

The Problem

The problem of this study was to determine the essential elements of retail salesmanship as practiced in department stores, and to construct a training manual incorporating the essential elements as

revealed by the investigation. The study was limited to the elements that could be analyzed from transcriptions of actual salesperson-customer cases.

Need for the Study

Existing retail sales training is centered around a traditional concept of salesmanship as conceived by management. The use of expert salespeople in verifying salesmanship principles has been mostly ignored. This study reveals the selling practices of expert salespeople. The findings will be helpful to stores in improving salesmanship and to schools in improving retail salesmanship instruction.

Procedure

Fifty expert salespeople in a large midwestern department store were recorded as they served at least one customer. Criteria for selecting salespeople were high volume of sales, year or more on the same job, and recommendation of supervisors. The Sound Scriber recorder was used. Then a check list of essential retail salesmanship elements was constructed from earlier studies, and verified by a jury of five authorities in retail selling. This check list contained twenty-four items.

Next, the transcribed recordings were searched for essential retail salesmanship elements. Each occurrence of such items was verified thrice; by a jury of experts, the salespeople themselves, and the supervisors of the salespeople involved. A total of 1437 examples of twenty-one elements were found. A manual of retail salesmanship was constructed from these elements.

Findings and Implications

1. The list of elements that are essential to retail salesmanship suggests that currently-used definitions of retail salesmanship are too limited in scope. Retail salesmanship is not entirely focused upon the objective of helping customers buy as definitions imply. It serves the broader purpose of helping customers obtain maximum, personal satisfaction for money spent.

2. Actual examples of selling by expert salespeople are obtainable from sound recordings. It would seem that such examples would authenticate retail salesmanship training materials as the usual hypothetical examples cannot.

3. Identical salesmanship elements are employed by the experts in thirty-two different selling departments, implying that selling methods are similar though merchandise and customers may differ.

4. Salespeople employ essential elements in convenient combinations as well as singly. A salesperson's remark frequently contains as many as five or more salesmanship elements. For an example see case 42, line 29, page 369 of the thesis.

Recommendations

Retail salesmanship courses in schools and in the stores should be re-examined in the light of the findings of this study.

Obviously, transcriptions of salesperson-customer cases do not tell the whole story of expert salespeople.

Additional research of voice qualities, appearance, manners, and gestures would shed additional light on the essential elements of retail salesmanship.

403 pages. \$5.04. MicA 55-99

RELATION OF UNITS TAKEN AND MARKS EARNED IN HIGH SCHOOL SUBJECTS TO NAVY SCHOOL ACHIEVEMENT

(Publication No. 10,137)

Lawrence Sydney Wright, Ed.D.
University of Missouri, 1954

Supervisor: H. H. London

Purpose of Study: To ascertain the relationship between units taken and marks earned in high school science, mathematics and industrial arts and subsequent achievement of men in the Electrician's Mates School, the Electronics Technicians School and the Machinist's Mates School, all located at Great Lakes, Illinois.

Sources of Data: Information regarding the units taken and marks earned in high school subjects by 726 selected navy men was obtained through an information form submitted to the principal of the last high school reportedly attended by these men. These data were then compared with the final grade earned in the navy schools as reported on the official graduation lists.

Summary and Conclusions: The number of units taken in high school science and industrial arts bears little, if any, relationship to achievement in any one of the three navy schools. However, the marks earned in these high school subjects have a direct and significant relationship to achievement in each of the three navy schools.

Neither the number of units taken nor the marks earned in high school industrial arts have much, if any, relationship to achievement in the Electronics Technicians School.

Both the units taken and the marks earned in high school mathematics have a direct and significant relationship to achievement in the Electrician's Mates School and the Machinist's Mates School, while in the Electronics Technicians School only the marks earned in high school mathematics were found to be so related.

In the case of navy men who had instruction in all three subjects, both the combined number of units taken and the combined marks earned in high school science, mathematics and industrial arts have a significant and positive relationship to achievement in the Electrician's Mates School. In the Electronics Technicians School and the Machinist's Mates School only the combined marks earned in these subjects were found to be so related.

While in isolated cases the number of units

taken in high school subjects may be related to achievement in navy schools, in general, a more consistent relationship exists between marks earned in high school subjects and navy school achievement.

The combined marks earned in high school science, mathematics and industrial arts are more closely related to achievement in the navy schools than are the marks earned in any one of these high school subjects alone.

From the size of the obtained coefficients of correlation it seems apparent that factors, as yet unidentified and unmeasured, are operating individually or in combination as contributors to navy school achievement.

Implications: Instruction in high school science, mathematics and industrial arts is contributive to success in the Electrician's Mates School, the Electronics Technicians School and the Machinist's Mates School in direct relation to the quality of work done in high school in these fields of study.

Parents, teachers, counselors, and administrators should continuously point out to youth that the quality of work is as essential during uncertain times as during times of peace. When youth want to know how to prepare for military service, it would seem that one could not be far wrong in advising them to do the best possible work in high school.

Both civilian and navy counselors and guidance personnel may find the results of this study valuable in counseling youth headed for, or already in, the navy.

Naval authorities who are responsible for recruitment and for the "Stay in School" policy of the navy should emphasize that to stay in school and to do the best possible quality of work may be of considerably greater importance than to just stay in school.

186 pages. \$2.33. MicA 55-100

EDUCATION, ADMINISTRATION

PATTERNS OF STAFF ORGANIZATION IN COMMUNITY UNIT DISTRICTS

(Publication No. 10,451)

William Henry Blatnik, Ed.D.
University of Illinois, 1954

The study was designed to collect and analyze data obtained from a selected group of fifteen community unit school districts in Illinois which would focus upon these purposes:

1. to describe the organization of central administrative staff found in selected community unit districts with particular reference to:

- (a) formal and informal organization
 - (b) provision for extension of participation to staff members
 - (c) communication
 - (d) perceptions of degree of democracy
 - (e) relation of pattern of organization to school district characteristics
2. to identify for further study appropriate problems existing in these selected community unit districts concerning the patterns of staff organization.
 3. to consider relationship of practices and opinions in the school districts studied to organizational theory reviewed from literature pertinent to the study.
 4. to make such recommendations as seem valid for the improvement of organizational structure in unit districts.

The development of the community unit school district since it was legalized in Illinois in 1947 provided an excellent opportunity for an exploratory study of patterns of administrative staff organization. By using reorganized districts composed of more than one previous district, the data could be collected from situations where recent attention to organization had been a necessity.

The pattern of staff organization was studied in fifteen unit school districts in Illinois. Small, medium-sized and large districts were selected in order to consider the possible relation of patterns of staff organization to size. The smallest and the largest districts were chosen and then a third group was chosen at random between these two extreme groups.

Interview schedules were designed to conduct recorded interviews with (1) superintendents and (2) central staff members other than superintendents. An organization chart was prepared during the visitation at each district. These charts are included in the study.

The data are reported in these broad areas (1) the organizational pattern, (2) factors affecting structural pattern, (3) respondents' opinions concerning the organizational structure in terms of efficiency and democracy, (4) staff participation, and (5) communications.

The major findings of the interviews are:

1. The line-and-staff organization was found in all fifteen districts.
2. None of the districts had written organization charts.
3. The financial factor did not appear to have a great bearing upon the pattern of organization in the districts studied.
4. The number of central staff employees with unit-wide responsibilities appeared to increase as the pupil population of the district increased.
5. Small district superintendents had the main responsibility for a greater number of functions than did the superintendents of the medium-sized or large districts. The medium-sized

district superintendents had the main responsibility for a greater number of functions than did the superintendents of the large districts.

6. An outstanding feature of the small district staff organization was generalized personnel and that of the large district was highly specialized personnel.
7. The superintendent's most important functions as perceived by superintendents and other central staff members are service-type functions.
8. Communication between superintendents and other central staff members was judged by respondents to be superior to communication among the central staff members.
9. As the sizes of the districts increased from small to medium-sized, to large, the devices for staff and citizen participation increased in number.
10. The majority of the large and medium-sized district central staff members other than superintendents were of the opinion that the superintendents' administrative practices were democratic. Most of the small school central staff members were of the same opinion as to the superintendents' administrative practices.
11. In the medium-sized and large districts superintendents were of the opinion that more authority could not be delegated without responsibility. The small district superintendents were of the opinion that some members of the staff did not want more authority.
12. The respondents of the large units generally indicated that there was a definite tendency towards all the staff as contributors to the performance of the administrative functions. The tendency in the small districts was not as great in the direction of the staff being contributors to the performance of the administrative functions.

Conclusions:

1. No identifiable classifications of patterns of organization were observed.
2. On the basis of the study the writer believes that it is necessary to have clear-cut patterns of formal organization in order to communicate efficiently.
3. There was a clear understanding on the part of staff members concerning the formal structure, however, staff members indicated that an organization chart clearly defining the lines and spheres of authority would be of some value to them.
4. In the small community unit school district so many different responsibilities may be assigned to one person that specific differentiation of roles may not be quite clear as to what the relationship should be in any particular instance. Clarification of functions might be helpful.

5. The central staff personnel should give attention to understanding the informal aspect of the organization and facilitating informal organization.
6. The greatest barriers to more democratic administration in the districts studied according to the respondents were: (1) traditionalism in the schools, (2) indifference on the part of the teachers, and (3) lack of understanding on the part of the teachers.
7. Communication in these units appeared to be superior and better provided for between the superintendents and other central staff members than did communication of central members with each other.

Recommendations for further study:

1. To identify the number of separate organizational patterns most reasonable and a classification of those useful for varying purposes within a given school unit (on the assumption that one district might have different patterns of organization for different purposes).
2. To investigate the problem of sharing responsibility along with authority.
3. To study the relationship of informal and formal organization.
4. To study the relation of the status administrators to the informal organization within the educational structure.
5. To study the informal organization and how administrators may best facilitate this aspect of organizational structure.
6. To study the means for enhancing the horizontal communication within the formal aspect of organization.
7. To study ways and means of overcoming barriers to more democratic administration such as those indicated by the respondents of the districts studied.

142 pages. \$1.78. MicA 55-101

STATE SCHOOL BOARD ASSOCIATIONS
IN TWELVE SELECTED STATES

(Publication No. 10,104)

Leslie Guy Carter, Ed.D.
University of Missouri, 1954

Supervisor: W. W. Carpenter

Purpose: The purpose of this study was an attempt to determine the contributions made to public education by state school board associations in twelve selected states.

Method of Research: Data for this study were

obtained by sending information blanks to the president and the executive secretary of each of the following state school board associations: Alabama, Florida, Georgia, Kentucky, Louisiana, Missouri, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, and West Virginia. Attended national school board workshop, conferences with national and state school board association leaders, and reviewed the available publications of state school board associations in the United States.

Summary:

- (1) In 1896 Pennsylvania organized the first state school board association; at the present time forty-four state associations are organized. The National Association of Public School Boards was organized in 1938. The association has changed its name several times, and is now known as the National School Boards Association with headquarters in Chicago.
- (2) The stated purposes of the twelve state associations studied were summarized as follows: (a) the general promotion of education; (b) efficient and effective support of the public schools; (c) service to one another by the exchange of ideas and information; (d) support of beneficial and opposition to injurious school legislation; (e) cooperation with all individuals and organizations concerned with the improvement of free public education.
- (3) Some accomplishments credited to these associations were as follows: (a) secured legal provisions for payment of association dues from public school funds; (b) sponsored district or area meetings for the in-service training of board members; (c) proposed legislation for the benefit of public education; (d) conducted workshops for study of school board problems; (e) promoted research projects; (f) unified efforts of organizations interested in public education.
- (4) Officers who assumed most of the leadership in state associations were the presidents and executive secretaries. The constitutions of state school board associations provided a source of authority for all officers.
- (5) Sources of revenue reported by association leaders were from memberships, sale of advertising, and state funds.
- (6) State associations desired to make many more services available to their member boards, if revenue were provided.
- (7) Percentage of eligible school boards enrolled in state associations ranged from seven to one hundred per cent.
- (8) Activities participated in by state school board associations were district, state, regional, and national meetings, workshops, and research projects. Services provided to

member boards were legislative, publications, and consultative services.

- (9) State school board association leaders reported cooperation from the following agencies: state teachers associations, superintendents organizations, secondary principals organizations, elementary principals organizations, classroom teachers organizations, state universities, state colleges, state boards of education, parent-teacher associations, and citizen lay groups.

Suggestions:

- (1) That the executive secretary be a full-time paid employee.
- (2) That statutory provisions be made in every state for local school boards to expend public funds for memberships in state school board associations, and for payment of expenses of representatives attending meetings.
- (3) That headquarters of state school board associations be as accessible to all parts of the state as possible, preferably at a university.
- (4) That state associations provide in-service training for school board members by workshops and district meetings.
- (5) That state school board associations offer consultative services to member boards.
- (6) That proposals for legislative consideration be determined by the united efforts of the state school board associations, educational agencies, and lay groups.
- (7) That an orientation manual be provided for each newly elected or appointed school board member.
- (8) That state school board associations establish one or more scholarships for graduate students, cooperating in research in school board relationships.
- (9) That state school board associations strive for one hundred per cent enrollment of local school boards.
- (10) That the National School Boards Association provide a monthly publication.
- (11) That all state school board associations affiliate with the National Association.

216 pages. \$2.70. MicA 55-102

THE RELATION OF THE PATTERN OF HIGH SCHOOL COURSES TO COLLEGE SUCCESS

(Publication No. 10,504)

Rudolf Eugene Leasman, Ed.D.
University of Illinois, 1954

This study dealt with the relation of the pattern of high-school courses to the quality of work in college as measured by grade point average for the first two years in four Illinois institutions of higher learning. The records of 1024 graduates of Illinois public high schools in the spring of 1950 were used in this study. Of this group, 665 completed two years of college and 359 withdrew prior to completing two years.

The basic design selected for this study was that of comparing the mean college grade point averages of two groups of students determined on the basis of the number of units of high-school preparation in the fields of English, foreign language, social science, mathematics, science, and non-academic courses. A simple analysis of covariance technique was used to test for significant differences in college grade point averages between groups of students who differed in number of high-school units in each of the six subject fields. This technique enabled one to account for individual differences in ability and aptitude as measured by rank in high-school class and the ACE Psychological Examination, respectively.

The relationship between college averages and number of high-school units in the six subject fields was also examined by means of the chi-square technique. The entire group of students completing two years of college at the four institutions was divided into two groups, above-average and below-average, on college grade point average (CGPA). For each subject field, a contingency table was set up with the number of units of high-school work ranging from zero to six. Where a significant value of chi-square was obtained, the method of matched cases was used to verify the finding with aptitude and ability controlled.

The group of students completing two years of college was compared with the group withdrawing from college before completing two years of college. Contingency tables were set up for each of the six subject fields, with the number of units of high-school courses ranging from zero to six. The relationship between the number of units of high-school work in each field and the length of time in college (two years or less than two years) was tested by means of the chi-square technique.

The main findings of this study were as follows:

1. The results of the whole study led to the conclusion that when the factors of ability and aptitude were taken into account, differences in the number of high-school units in any one of the subject fields here studied did not lead to statistically significant differences in college achievement as measured by college grade point averages.

2. When the factors of ability and aptitude were not controlled, students with high-school majors (three or more units) in foreign language or in mathematics achieved higher college grade point averages

than did the students with fewer units in either of these fields.

3. When the factors of ability and aptitude were not considered, students with four or more units of high-school English or students with three or more units of high-school mathematics remained in college longer than did the students with fewer units in either of these fields.

109 pages. \$1.36. MicA 55-103

A MEASURE OF THE ABILITY OF CERTAIN SELECTED CONNECTICUT COMMUNITIES TO SUPPORT PUBLIC EDUCATION

(Publication No. 10,431)

Creighton Francis Magoun, Ph.D.
University of Connecticut, 1954

The Problem

There is a serious need in Connecticut for a measure of the fiscal ability of the communities to support public education. Until this ability is determined, no satisfactory formula for distributing state funds to public schools can be established.

It has been the purpose of this dissertation to develop an index of ability to finance public education in Connecticut. In order to accomplish this purpose it was first necessary to obtain a value of taxable property for Connecticut communities, which, when divided by the respective measure of educational need, would yield the required index.

No attempt is made to use the index of ability developed in a formula for the apportionment of state grants-in-aid.

Procedure

A careful examination was made of all material on school finance practices that had a bearing on the determination of value or the measure of need. Such material included: (1) finance practices of the forty-eight states, (2) equalization in Connecticut, and (3) current assessment practices and revaluation in Connecticut. From this material and 1951 data that included (1) base year and level of revaluations, (2) complete tax lists, (3) per pupil costs, and (4) ADA and ADM figures, an index was developed.

Findings

Units of value used by forty-two states in apportioning equalizing funds were (1) actual value (or per cent), (2) equalized ratio, (3) economic taxpaying indexes, and (4) assessed value. (Chapter II, Table I.) Measures of need used were (1) budget approval, (2) census, (3) ADA or ADM, and (4) weighted-pupil or classroom. (Chapter II, Table II.)

Equalization practices and research in Connecticut from 1639 to 1951 developed the following units of value: (1) grand list, (2) annual tax receipts,

(3) number of teachers, (4) population, (5) property sales, and (6) assessors' opinion. Measures of need developed were (1) pupils, (2) teachers' or superintendents' salaries, (3) transportation, (4) census, and (5) weighted-pupil. (Chapter III.)

Current assessment practices were found to represent an insecure base on which to estimate value. (Chapter IV.) Value based on reappraisal data was found to represent a valid unit of value. (Chapter V.) The weighted-pupil unit was developed as the most refined measure of need. (Chapter VI.) Using these units of value and need, indexes of ability of seventy-five Connecticut cities and towns to support public education were found. (Chapter VII.)

Conclusions

1. Under existing conditions it is not practical to develop economic indexes of taxpaying ability in Connecticut.

2. Raw assessment figures used for comparative purposes are unreliable.

3. Sales value does not represent an overall measure of value.

4. Reappraisal of property by an outside firm gives a valid measure of property.

5. The weighted-pupil is the most refined measure of school need.

6. As long as equalization exists between classes of property, building values (taken percentage-wise) are indicative of the total value of property.

7. Building value (percentage-wise) divided by the weighted-pupil gives the index of fiscal ability.

8. Seventy-five Connecticut communities show a range of eight to one in fiscal ability to support public education.

9. No significant correlation exists between the size of the indexes and the size of the communities.

145 pages. \$1.81. Mic 55-2

ANALYSIS OF THE INCIDENCE AND COST OF NON-PROMOTIONS IN THE PUBLIC ELEMENTARY SCHOOLS OF THIRD CLASS DISTRICTS IN PENNSYLVANIA

(Publication No. 9985)

Edson Boyd Powell, Ed.D.
University of Pittsburgh, 1954

This is an analytical survey to determine the incidence and cost of nonpromotion and the relationship of various factors to nonpromotion in the elementary schools of selected school districts in the state of Pennsylvania. An extensive study was made of 117 third-class school districts for the year 1952-53 and an intensive study was made of the Greensburg Public Elementary Schools for the years 1941-53.

A review of research and other literature concerned with the problem of nonpromotion led to the utilization of the following factors for extensive study in the state of Pennsylvania: (1) grades, (2) size of

district, (3) average number of pupils per teacher, (4) percentage of attendance, (5) instructional cost per pupil, and (6) current expense per pupil. Information which could be used in developing these specific factors was recorded for further study and statistical treatment. These data were transcribed directly from reports submitted by individual districts, and on file in the Department of Public Instruction. A fifty per cent sampling of third-class school districts having 6-6 or 6-3-3 plans of organization was the basis for arriving at the total of 117 school districts representing 48 different counties.

Correlations derived by using the Product-Moment Method, and per cent analyses indicated the lack of a significant relationship between the per cent of nonpromotion and all factors studied except for grades.

Factors employed for an intensive study of nonpromotion in the Greensburg Public Elementary Schools included (1) range of years, (2) grade, (3) sex, (4) frequency of retentions per pupil, (5) drop-outs, (6) highest grade attended by drop-outs, and (7) frequency of subject failures. Data were collected, therefore, to facilitate the development of these factors.

Per cents of nonpromotion in Greensburg were highest during the years 1941-45, and throughout the first grade. Approximately two-thirds of the total retentions were males, but girls were retained more frequently than boys in the intermediate grades. Individual pupil retentions varied from one to four times, and more than one-third of these people dropped out of school prior to graduation, with grade nine having the highest per cent of the number. Reading ranked highest in the list of subject failures.

The average cost of nonpromotion, when based on instructional costs for high expenditure districts, is less than that for medium expenditure districts, but more than that for low expenditure districts; however, per cent of instructional cost used for nonpromotion is lowest in high expenditure districts. When based on current expense costs, high expenditure districts are first in rank, medium expenditure districts are second, and low expenditure districts are third in average costs of nonpromotion; but again the per cent of current expense cost used for nonpromotion is lowest in high expenditure districts.

When based on instruction or current expense cost, the average cost of nonpromotion in Greensburg is almost double the average for 117 other third-class school districts in the state.

The results of this study indicate that average per cents of nonpromotion apparently have not dropped an appreciable amount in the past 20 years. School systems should enable children to progress from grade to grade, and teachers should insure continuous and uninterrupted progress by knowing the strengths and weaknesses of each child. Prodigious amounts of money are expended for nonpromotions in the state of Pennsylvania. Whether or not this money is entirely wasted is debatable, but it is nevertheless spent. Research, however, certainly indicates that this money could be more advantageously expended. 242 pages. \$3.03. MicA 55-104

THE ADMINISTRATION OF PUPIL PERSONNEL SERVICES: A COMPARATIVE STUDY OF SERVICES IN THE UNITED STATES AND QUEENSLAND, AUSTRALIA

(Publication No. 10,535)

Samuel Alan Rayner, Ed.D.
University of Illinois, 1954

This study compares the administration and organization of pupil personnel services in the public schools of the United States and Queensland with a view to selecting aspects of American purposes and practices most suitable for trial as means of meeting defined or emergent needs in Queensland. Since the roots of education lie deep in the national culture, a review of the cultural and educational backgrounds precedes the comparison of pupil personnel services.

The perspective which emerges from this analysis is that the educational history of Queensland has been marked by stability and slow change rather than by the prompt recognition of developing needs and by the discovery of original methods of meeting those needs. The two cultural factors most likely to impede educational change are the relative shortages of persons with a tertiary education and of financial resources. Educational impediments to change are the large classes in Queensland schools and the early school leaving age.

The comparison has been restricted to three important aspects of pupil personnel services:

- (1) attendance and child accounting;
- (2) guidance; and
- (3) clinical services.

These comparisons reveal many similarities in the practices of the two countries. These are due, in large part, to the development of guidance and clinical services in Queensland within the past decade after a review of the literature on such services in other Australian states, Britain, and the United States. The principal difference between Queensland and the United States lies in the lack of any attendance service in Queensland.

The study concludes with suggestions on the priority that should govern the application of American principles in Queensland. Among the changes that may be introduced by the guidance branch as matters of internal policy are a reduction in the case load of guidance officers and an increased emphasis on work with maladjusted children. Other useful techniques include the replacement of the present record card by a folder, the introduction of Rogerian interviewing techniques, and the use of therapy in a few suitable cases. Among the changes that must be supported by senior administrators, the most important are the appointment of additional guidance officers, the establishment of a school attendance service, and a survey of the mental health of pupils.

As the many similarities in the programs of the two countries indicate that Queensland has already adopted many of the most successful American

practices, the ground seems well-prepared and the cultural climate suitable for the transplantation of additional principles and practices from the United States.

206 pages. \$2.58. MicA 55-105

**THE ORGANIZATION AND ADMINISTRATION
OF PUBLIC RECREATION IN THE
STATE OF NEW YORK**

(Publication No. 6308)

George Jay Schoengood, Ed.D.
New York University, 1953

This study is an analysis of the recreational services being rendered by the state agencies to municipalities in the State of New York with a view of recommending administrative procedures which will best serve the local political sub-divisions of the State. The investigator proceeded in the following manner; first, the investigator tried to determine the existing conditions of organization and administration with respect to public recreation, second, the investigator obtained data with regard to the number, type and quality of recreational services rendered by the state agencies, third, the investigator derived a set of recreational principles, and fourth, the investigator made specific recommendations based upon the data collected in the course of the study which might improve the number, type, and quality of recreational services now being rendered.

The present study was undertaken in view of the fact that no study of New York State recreational services was accomplished heretofore and because leaders in public recreation had expressed the need for such study to the investigator in a series of interviews. The study is significant because it is of direct concern to the state agencies now engaged in rendering recreational services. The need for the study is substantiated by the data collected revealing the lack of coordination now existing among the state agencies rendering recreational services.

The investigator went to Albany, New York to gain a first hand knowledge of the existing conditions of organization and administration in public recreation. The investigator collected the data via personal interviews, field trips, and perusal of office files.

A questionnaire was used to discover the number, type, and quality of recreational services being rendered by state agencies to municipalities. The questionnaire was divided into the following areas; legal, technical (physical planning and research), finance, and leadership (personnel, employment practices, and training).

The recreational principles were derived after a study of the state recreation commissions of North Carolina, California, Vermont, and Washington, and a review of the professional literature in the field. The principles were catalogued in the following areas:

1. General
2. Legal

3. Technical (Areas and Facilities)
4. Planning (Physical)
5. Planning (Program)
6. Research
7. Finance
8. Leadership
9. Community Relations (Public Relations)
10. Coordination

The principles were validated theoretically through the professional literature in the field and then commented on by a jury of experts including Stanley S. Winans, Director of Recreation of the California State Recreation Commission, Dr. Harold D. Meyer, Chairman of the North Carolina Recreation Commission and Director of Recreation Courses at the University of North Carolina, and Professor Garret Eppley, Chairman of the Indiana State Advisory Committee on Recreation and Chairman of the Department of Recreation at Indiana University and in practice by the Bureau of Physical Education of the State Department of Education and the New York State Youth Commission.

The following general recommendations were made with respect to improving the recreational services of state agencies to the political sub-divisions:

1. A uniform state wide recreational policy should be established for the State of New York.
2. There should be more effective liaison and coordination among the state agencies.
3. There should be greater service coverage to municipalities by state agencies.
4. There should be a state clearing house established wherein all inquiries pertaining to public recreational services and administration may be directed.
5. There should be a central body to give direction and guidance to the state agencies. (Proposed New York State Recreation Commission).
6. There should be a systematic codification of all public recreational workers.

It was also suggested that the proposed New York State Recreation Commission review the recreational principles derived and utilize them as a guide in the administration of public recreation for the State of New York.

386 pages. \$4.83. Mic 55-3

THE USE OF LAY CITIZENS ADVISORY
COMMITTEES IN SELECTED
MISSOURI PUBLIC SCHOOLS

(Publication No. 10,131)

Herbert Woodrow Schooling, Ed.D.
University of Missouri, 1954

Supervisor: John Rufi

It was the purpose of this study to determine the extent to which citizens advisory committees have been organized in selected Missouri public schools; to determine the types of such committees as may exist; to ascertain the attitudes held by administrators in selected public schools as to the value of such committees and the responsibilities and functions they may properly assume; and to inquire into the origin, organizational procedure, and accomplishments of such committees.

One hundred eleven of the one hundred fifteen classified AAA schools in Missouri were included in the study. A survey of committees organized and administrators' opinions regarding their use and function was made in each of these schools. Detailed study was made of the development, organization, and accomplishments of lay committees in twelve of the schools.

The study revealed that:

1. Lay citizens advisory committees have been organized in many Missouri public schools. Of the one hundred eleven schools included in the study, 81.08 per cent reported the organization of lay citizens committees.

2. Various purposes have prompted the organization of the citizens committees in the schools participating in the study. Frequently, the committees had been organized to meet immediate needs, such as those related to school housing requirements or school district reorganization. Forty and fifty-four hundredths per cent of the schools studied had organized committees to assist with school building problems. Some schools had established long-term, continuing committees to meet broad, long-range needs. Fifty-eight and fifty-six hundredths per cent reported such committees.

3. School administrators participating in the study expressed many concerns relative to the organization of lay citizen groups. How to define and limit the responsibilities of such groups was a major concern to more than 90 per cent of the administrators. Four-fifths of the number expressed feelings of inadequacy relative to the administrative responsibilities involved in working with lay committees and indicated a need for additional training and research in this administrative area.

4. Many common factors enter into the development, organization, and function of lay advisory committees. Local community characteristics and needs, however, dictate the particular pattern followed to achieve desired outcomes. This conclusion is based upon results of a detailed study of the development of lay committees in twelve selected schools. Each of the committees studied was organized as a result

of board of education initiative and action. In all instances, a close working relationship was maintained between the board of education and the lay committee. Three methods were employed by the participating schools in selecting members for the lay committees. In half of the schools, members were selected by the board of education. In five of the schools, representatives to the committee were selected by community organizations. In the remaining school, a combination of the two mentioned plans was used.

5. The schools participating in the study cited a number of specific accomplishments attributed to the organization of lay committees. Included in these values and accomplishments were: increased lay interest in the schools, a greater awareness of school needs, development of effective lay leadership, development of a spirit of cooperativeness and unity, and a desire to use the resources of the district to meet school needs.

6. In connection with the work of the lay committees organized, no difficulties of serious consequence were reported by administrators in the participating schools.

7. In determining the responsibilities which lay committees may properly assume, participating administrators agreed, in general, that responsibilities involving school building and financing programs were legitimate concerns for lay committees; that problems whose solution involves professional background and training were not proper considerations for lay committees.

213 pages. \$2.66. MicA 55-106

BUSINESS PRACTICES IN
MISSOURI PUBLIC SCHOOLS

(Publication No. 10,134)

Roscoe Linn Terry, Jr., Ed.D.
University of Missouri, 1954

Supervisor: W. W. Carpenter

Purpose: The purpose of this study is to determine as far as possible the business practices being carried on in Missouri public schools and to call attention to practices considered desirable by a jury of experts.

Method of Research: Questionnaires were sent to three hundred fifty school superintendents of Missouri public schools, (two hundred and eleven of whom returned the blanks) of over three hundred total enrollment exclusive of St. Louis, Kansas City, and St. Joseph. The superintendents were asked to indicate the practices used in their schools in each one of five areas of business.

An opinionnaire was sent to sixteen men who had majored in the area of educational

administration, have their doctoral degrees from the University of Missouri, and who were either superintendents in Missouri public schools or who had recently served in such positions. These sixteen men composed the jury of experts.

In an attempt to show variations in business practices among school systems of different sizes the schools were divided into four enrollment groups as follows: group one consisted of fifty schools with enrollments over one thousand; group two consisted of sixty one schools with enrollments from six hundred to one thousand; group three consisted of fifty schools with enrollments from four hundred fifty to six hundred and group four consisted of fifty schools with enrollments from three hundred to four hundred fifty.

Areas Covered:

Business Management

Training of the individual responsible for business management, employment and management of the secretarial and clerical staff, records, equipment and services of the business office.

Administration of Financial Procedure:

Budget procedure, financial accounting, auditing school financial records, bonding practices, safeguarding school funds, internal accounting and financing public relations.

Administration of School Property:

Insurance, school plant and property, operation of plant and maintenance of plant.

Administration of supplies:

Purchasing supplies, receiving and storing supplies, issuing supplies and payment for supplies.

Transportation

General provisions, Contracted transportation, and district owned transportation.

Conclusions

The business practices of Missouri public schools agree rather closely with the recommendations of the jury of experts.

Schools with an enrollment over one thousand more nearly agree with the recommendations of the jury of experts in connection with the professionalization of the secretarial, clerical, operational and maintenance staffs than do the other enrollment groups.

Schools with an enrollment of over one thousand more nearly agree with the jury of experts in relation to the safeguarding of school funds than do the other enrollment groups.

Schools with enrollments between three

hundred and four hundred fifty provide fewer precautions for safeguarding school funds than do any of the other enrollment groups.

Schools with enrollments between three hundred and four hundred fifty do not agree as closely with the jury of experts in relation to the professionalization of the secretarial, clerical and maintenance staffs as do the other enrollment groups.

315 pages. \$3.94. MicA 55-107

A PROPOSED FINANCIAL PLAN FOR STATE SUPPORT AND DISTRIBUTION TO THE PUBLIC SCHOOLS IN MISSOURI

(Publication No. 10,138)

Harold Lloyd Young, Ed.D.
University of Missouri, 1954

Supervisor: J. S. Maxwell

Purpose: To formulate a financial plan for state support and distribution to the public schools in Missouri.

Method of Research: Data were obtained from official records and reports in the offices of the Missouri State Department of Education, the constitutions of Missouri, laws of Missouri, and selected Missouri Reports of the Public Schools. A survey of the programs and expenditures of forty-six Missouri Class A high school districts was made.

Summary: 1. From early statehood, school laws have been retained, added to, or altered until a complicated system of state support for every district of the state has developed.

2. The present plan of state support consists of equalization, general, and special aids.

3. The study of the programs and expenditures of the forty-six high school districts revealed the following information:

- a. The mean average daily attendance of the forty-six high school districts studied was 600.7.
- b. Of the 1,144 teachers, exclusive of administrators, sixty-eight per cent had at least one hundred twenty semester hours of college training.
- c. The mean ratio of pupils to teachers was twenty-two and two tenths.
- d. The mean number of units offered in the high school programs was thirty-five.
- e. Forty-two of the forty-six districts were employing at least one teacher per grade.

- f. The most commonly offered special service was the school lunch program.
- g. Transportation service was provided for fifty-one per cent of the students with the use of 313 buses.
- h. The mean assessed valuation back of each resident pupil was \$6,268.
- i. The mean levy for current school expenses was one dollar and seventy-two cents.
- j. The mean per pupil expenditure for current school expenses, exclusive of transportation, was \$184.67.
- k. The mean per pupil expenditure for capital outlay, exclusive of new structures and buses, was ten dollars and six cents.
- l. The mean monthly expenditure for transportation was six dollars and eighty-two cents per transported child.

Recommendations: 1. Missouri should set up a foundation program which guarantees two hundred dollars to every child in the state for all expenditures exclusive of transportation and building construction.

2. The transportation cost should be determined according to the number of pupils transported and the number of miles traveled.

3. On a state wide basis, the uniform tax rate should be one dollar and ten cents per one hundred dollars assessed valuation before a district may participate in the foundation program.

4. The tax rate should be adjusted for each county according to recommendations based on periodic studies to be made by the State Tax Commission.

5. Districts with high assessed valuation per child may elect to receive a flat grant of eighty-five dollars per resident student in lieu of the foundation program guarantee.

6. The attendance of non-resident students should be claimed by the sending district in determining the cost of their foundation program.

7. The state should provide aid for school building construction in districts qualifying as permanent centers after they have exhausted their bonding capacity.

8. Money in the local districts should be administered through two funds.

9. Funds should be distributed from the state six times per year.

10. Districts should operate school for at least one hundred eighty days to participate in state support.

11. The isolated common school district may use seventeen pupil units in computing the foundation program costs.

284 pages. \$3.55. MicA 55-108

EDUCATION, ADULT

A STUDY OF THE APPLICATION OF MACHINE BREAKDOWN ANALYSIS AS A METHOD FOR DETERMINING INSTRUCTIONAL CONTENT FOR TRAINING MACHINE MAINTENANCE MEN

(Publication No. 10,599)

Joseph Ernest Milano, Ph.D.
Cornell University, 1954

Technological developments in production machines and equipment, and the accompanying changes in methods and procedures accentuate the need for efficient maintenance and repair. Speed and efficiency in servicing production machines become more critical as manufacturing processes incorporate automatic machines and equipment and high speed production machines.

Studies and surveys indicate that machine maintenance is now, or will become shortly, a serious problem. The main factor appears to be the shortage of maintenance personnel with the required skills and knowledges demanded to maintain and repair complex machine innovations. The maintenance concern is shared by manufacturers dependent upon standard multipurpose semi-automatic and automatic machines and industries incorporating automated features in production.

The adoption of a systematic procedure for determining industrial content for training machine maintenance men may aid industry to meet the problem with assurance - through current data on the ever-changing skills within the crafts.

The development of the Multipurpose Analysis Technique for the U. S. Navy, a study of the Gunner's Mate Rating relative to the complicated 3"/50 Rapid Fire Twin Mount, provided the background for the application of machine breakdown analysis as a means for determining instructional content for training machine maintenance men. The similarities of conditions in the U. S. Navy and industry justified the application.

The study was conducted in a metal processing industry. Machine breakdowns and service requirements were reported on specially designed Breakdown Schedules. Machine Maintenance Summary Records were devised and set up for each machine and the accumulative data provided quick and easy review of the maintenance requirements.

The human relations problem encountered in overcoming the initial resistance of the maintenance personnel, and the training of the Plant Engineer to insure his understanding of all possible benefits

from the use of the breakdown reports are a part of the study.

Instructional content was sought through analysis of the repair methods and procedures used by the maintenance personnel as revealed in the completed breakdown reports which included: the identification of the machine; the description of the symptom of the malfunction; the analytical steps taken to diagnose the breakdown; the steps taken to effect the repair; the cause, and recommendations for prevention of recurrence. The summary records for each machine provide a means for reviewing the services performed, labor costs, and frequency of breakdown.

The corollary findings include the Plant Engineer's statements indicating how the use of the breakdown reports benefited the plant in terms of costs and control. The twenty conclusions of the study may be summarized as follows:

1. The growing need for technically trained maintenance personnel may require the cooperative action of industry and education experts to satisfy the maintenance demands of complex machines.
2. Instructional materials are needed to train maintenance personnel servicing modern production machines and equipment.
3. Instructional content for training machine maintenance men may be determined through analysis of machine breakdown reports.
4. Breakdown reports are useful for developing preventive maintenance programs.
5. Breakdown reports are valuable for assessing repair costs vs. machine replacement, appraising the merit of maintenance personnel, and for determining manpower requirements as well as machine service needs.
6. Breakdown reports are an aid to improved maintenance, higher standards of work, performance, and higher level of morale.
7. Breakdown reports provide data for current, up-to-date job analysis of maintenance crafts; data which are useful to the employment division and wage and salary division as well as the training division.

286 pages. \$3.58. MicA 55-109

A STUDY OF SELECTED INTERACTION EXPERIENCES AMONG A GROUP OF CITIZENS CONDUCTING A STUDY OF THEIR CITIZENS' COMMITTEE ACTIVITIES

(Publication No. 6303)

Helen deRamus Mitchell, Ed.D.
New York University, 1953

Chairman: Assistant Professor John W. Tietz

Statement of the Problem

This was a study of selected dynamics of interaction experiences operating in a citizens group. Selected dynamics of group experiences referred to roles functioning in group process. Data on status of role functions were gathered from a study of group setting, in which the group members were concurrently studying the activities of their Citizens' Committee. The latter activities which covered six sessions, involved considerations of philosophy, evaluation of past activities, and program of the Citizens' Committee activities.

Method and Procedure

Evaluations of role performance were based upon a set of criteria developed by the investigator. A survey was made of the literature, from which a master list of a variety of roles was drawn. The roles were listed under three categories: problem solving roles, group atmosphere and roles related to group failure.

Qualitatively each role was subjected to three conditions based upon type of discussion, i.e. philosophy, evaluation, program. The conditions were: (1) the desirability for including all roles from the master list in each of the six sessions of the study project, (2) the desirability of considering certain role functions as more effective when a single individual performs those duties throughout the meeting, (3) desirability of each person who participated in a session to have assumed certain roles at least once during the discussion period.

Criteria for each role was established only after there had been a measure of agreement between the investigator's tentative list and two-thirds agreement among a jury of experts.

Summary

Eight roles were evaluated under problem solving activities. These roles were: initiator, information seeker, information giver, elaborator, opinioner, coordinator, orienter and energizer. The information giver was the only role which met criterion for each of the six sessions.

Roles under group atmosphere were found to meet the criteria more often than did the problem solving roles. Three of these roles were found to be adequate for six sessions. Group atmosphere roles were encourager, harmonizer, compromiser, expeditor, standard setter, follower and status role.

Eight roles were listed under group failure activities. These were: aggressor, blocker, recognition seeker, dodger, dominator, help seeker, special interest pleader and blamer. Three of these roles

were not found in any of the six sessions. The aggressor was the most prominent group failure role appearing in all sessions.

Evaluations were also made of each member performances for all sessions attended. Suggestions for the improvement of role performances were included in each individual evaluation. Individual performances were identifiable only by code number. A table was devised to show analysis and evaluations of member performances per session.

A suggested plan for strengthening the group discussion process involved in solving community problems based upon this investigation was presented.

Conclusions

1. The survey of interaction experiences in this study revealed a range from absolute non-participation to comparatively highly developed sensitivity to role performances.

2. The unequalled quantitative and qualitative performance indicated a need for planning a program designed to assist in improving role requirements of the group discussion process.

3. Further research in role proficiency in group process should consider the causes of non-participation and lower quality range performances.

4. Additional research is needed on relationship between absenteeism and role performance.

5. Research technicians in group dynamics might give considerable attention to developing criteria for a variety of discussion types which might be universally applicable. Inductively determined, such a set of criteria conceivably would contribute immeasurably to our knowledge of role evaluation. Productivity found in control and experimental groups would be useful toward this end.

149 pages. \$1.86. MicA 55-110

EDUCATION, HISTORY

THE HIGH SCHOOL AT THE TURN OF THE CENTURY: A STUDY OF THE CHANGES IN THE AIMS AND PROGRAMS OF PUBLIC SECONDARY EDUCATION IN THE UNITED STATES, 1890-1900

(Publication No. 10,515)

Bernard Mehl, Ph.D.
University of Illinois, 1954

The study is concerned with major developments of public secondary education during the '90's and attempts to view the problems and trends adhering to the rise of the high school. Drawing mainly from national, state and city school reports and proceedings and addresses of educational associations, the study documents the thoughts and actions of educators as they sought to formulate the basic core of high school education.

By 1890 the public high school in the United States had become the dominant secondary educational institution in a nation undergoing rapid material and social change. The high school, it was claimed, had become the "people's college," offering higher education to all elements of the population. The high school was also deemed the "great leveler," in that it would reduce if not eliminate the division existing between classes and thus lessen the societal evils. However, the high school educator did not effect the hopes expressed by the terms "people's college" and "great leveler," but he did inherit the problems which these hopes - representing two wings of the American educational tradition - bequeathed.

Seeking to maintain the ladder system of education and provide education for more of the masses was a major quest engaged in by the educator. The solution, for some, called for an inclusion of the "new subjects" comprising the fields of English, history, social science, science. Others wished to include manual training and commercial arts, still others turned their backs on the problem and insisted on a return to a classical program, while some demanded a moral and civic content for the high school program. The problems set the stage for the Committee of Ten.

The committee's was a progressive answer and paved the way for subsequent reforms which extended basic secondary education to all youth. The committee parted with the doctrine of formal discipline introducing in its stead a modified Herbartian view of apperception and correlation. The committee, although centering on subjects, made clear its position that subjects have no claim of distinction within themselves. Echoing the thoughts of its chairman, C. W. Eliot, the committee claimed that subjects should give the student the power to act not in the abstract but in the concrete everyday world. The committee accepted a limited concept of election which was already in effect in many high school programs, and upheld the notion that a core of general education be held intact for secondary education.

The report was one of the most far-reaching educational documents. Although attacked as being either too radical or too conservative it actually hewed to a middle of the road reform position. However, this position in education like the mugwump position in politics was a move forward in the direction of major educational reform.

359 pages. \$4.49. MicA 55-111

THE ROLE OF THE SCHOOL IN A TRANSITIONAL SOCIETY

(Publication No. 10,533)

Robert Elmer Potter, Ed.D.
University of Illinois, 1954

This is a study of schools and colleges in societies undergoing the preliminary stages of social revolution. It attempts to determine if there is any

relationship between formal education and the development of conflicts and tensions within the society and to discover specifically if schools and colleges have ever been used systematically as agents for directly propagating revolutionary ideas within the society.

The first chapter is a summary of the literature on social revolution. Particular attention is given to the nature of social revolution with its causes, symptoms, and development up to the point of the outbreak of the revolution. This study defines this pre-revolutionary period as the "transitional society."

Formal education in eight transitional societies is examined in the body of the study: the American Revolution of 1776, the American Civil War of 1861, the French Revolution of 1789, the Prussian Revolution of 1848, the Chinese Revolution of 1911, the Russian Revolution of 1917, the German Revolution of 1918, and the Spanish Revolution of 1931. More than half of the thesis is devoted to a very detailed study of formal education in the two American periods, with the chapters on the other transitional societies being considerably shorter.

The schools and colleges of these transitional societies were examined to determine such questions as the following: (1) the number of schools and colleges and of pupils in attendance; (2) the length of the school day and year, and the number of years most students attended; (3) the professed aims of the educational system; (4) the curriculum, textbooks, and methods used in the schools; (5) the training, background, and non-teaching activities of the teachers; (6) the supervision and inspection of education; (7) the criticism of contemporaries and accounts of visitors and teachers; (8) the activities engaged in by students outside of class; (9) the role played by graduates and students during the transitional and revolutionary periods.

The major conclusions were that: (1) the schools and colleges were not direct agents for propagating revolutionary doctrine in any of these societies; (2) the schools and colleges did not teach students to examine social issues critically and rationally and did not attempt to teach a method for solving crucial social issues; (3) the schools and colleges were agents for the defense of the *status quo*, sometimes through design by attempting to indoctrinate an attitude of loyalty to the old regime regardless of its faults and need for change, sometimes through default by avoiding any discussion of the crucial social issues; (4) the schools and colleges, through developing intellectuals with powers to analyze critically and evaluate existing institutions, and through teaching the general population to read, probably contributed indirectly to the growth of tensions and conflicts leading to the eventual revolution.

The concluding chapter presents a brief historical summary of the idea that peaceful change through rational processes is the method of social change appropriate to democracy and that education is one instrument for making possible a democratic citizenry capable of utilizing rational processes for solving social issues. In the transitional societies studied, the schools and colleges were not permitted the academic freedom necessary to provide an education

fitting the people for such peaceful change. Finally, the conclusion briefly points out comparisons between the repressions which were exercised against the schools and colleges of these past transitional societies, which eventually suffered revolution, with the limitations currently being placed on academic and intellectual freedom in the United States.

536 pages. \$6.70. MicA 55-112

EDUCATION, INDUSTRIAL

HIRING, ADVANCEMENT, AND TRAINING PRACTICES IN SELECTED ST. LOUIS AREA INDUSTRIES

(Publication No. 10,101)

Walter Charles Brown, Jr., Ed.D.
University of Missouri, 1954

Supervisor: H. H. London

Purpose of Study: The purpose of the study was to obtain information relative to the hiring, advancement, and training practices in industrial-type jobs in selected St. Louis area industries and to ascertain how education relates to these practices.

Sources of Data: Data for the study were obtained from the Missouri Division of Employment Security; management associations in the area; interviews with personnel men and training officials in the selected industries; record forms and labor-management contracts; and literature pertinent to the study. The study included 46 industries in 15 major industrial groups in the St. Louis area - 10 durable manufacturing industrial groups and five non-manufacturing industrial groups.

Summary: All of the 46 industries studied were unionized, except one. The AFL accounted for approximately three-fourths of the union representation; the CIO nearly one-fourth; and the Independent union two per cent. The union shop type of union security occurred more frequently than any other type; preferential hiring clause was second in frequency and maintenance of membership was third.

The mean minimum hiring age of the industries included in the study was 18.5. Over half of the industries did not have, as an established practice, a maximum hiring age. None of the industries preferred to hire workers who were less than 18 nor more than 50 years of age. Workers who were between the ages of 25 and 35 would find themselves preferred in three-fourths of the industries.

Over half of the industries had a practice of hiring "all races," however, fewer industries preferred to do so.

Religious faith, marital status, military status, and having relatives working for the company were of little importance to an applicant in getting a job.

A little over half of the industries hired handicapped workers in departments where they could do the work.

Four-fifths of the industries had no minimum formal education requirement for applicants. Few industries actually required, but over half gave preference to, applicants with a high school education. The great majority of the industries studied gave preference to the applicant who had had special training, and approximately one-fourth made it a requirement of employment on certain jobs.

The sources of job applicants used by the industries in rank order of importance are: "walk-ins"; advertisements; "friends of employees"; public employment service; unions; "other," such as Urban League and trade schools; public schools; and private employment service.

Factors which affected the assignment of new employees are as follows: "openings at the time"; "other," such as physical fitness and marital status; previous experience; previous training; union requirement; "expressed interests"; age; and amount of formal education.

Seniority was the chief factor in the promotion of workers within industrial-type jobs, and low seniority was the primary factor in determining the order in which workers were laid off. In the promotion of workers to supervisory positions, "qualifications of the worker" was the controlling factor.

Slightly less than half of the industries rated their workers on merit. Ratings most frequently included the following: quality of work; quantity of work; attendance; and cooperation.

In five of the 46 industries, workers could not transfer from one department or job family to another; in one-third, if they did transfer, they had to begin at the bottom in job grade and pay; and in less than half of the industries studied, workers could transfer in present job grade or higher.

In 41 of the 46 industries, industrial training of one or more types was provided industrial workers by either the industry, the union, or both. The following industrial training programs were offered: organized classes; organized apprenticeship programs; union classes; organized progression programs; and training through educational refund.

220 pages. \$2.75. MicA 55-113

EDUCATION, PHYSICAL

A PLAN FOR THE ADMINISTRATION OF RECREATION IN THE STATE OF IDAHO

(Publication No. 6296)

Leon Grant Green, Ed.D.
New York University, 1953

The Problem

The purposes of this study are to identify the state agencies which provide recreation services in Idaho; to describe the need for such services; to formulate recreation principles which may be used to establish state-wide practices for providing the same; and to make recommendations for their administration and supervision.

The Significance of the Study

The interest developed during the last ten years in state recreation programs throughout the United States has been significant. Many states have established recreation commissions or interdepartmental agencies for the purpose of implementing recreation programs on a state-wide basis. Idaho has as yet made no such provision but the increased demand and the mounting professional interest in recreation make a comprehensive program essential. Without it recreation is a part-time function of the different state departments resulting in endless duplication and confusion.

The Method of Collecting Data

The factors taken into account in preparing this paper included the following: study of recreation literature, preparation of the outline, review of related studies, preparation and tabulation of questionnaires, compiling and writing the material, development of state recreation principles, and the formulation of recommendations.

The first problem involved in the study was to determine what other states are doing in the area of public recreation. All of the forty-eight states were requested to send information about the types of recreation services being provided. This information was reviewed and the important factors noted.

The second problem was to investigate the recreational services that are being provided by state agencies in Idaho. A questionnaire was developed and sent to each department head in the state. The information received from the questionnaire and by personal interview was analyzed and recorded.

The third problem was to investigate documentary literature to determine the needs of the people for recreation services. A questionnaire was designed and sent to selected PTA groups in the state to determine what they believed to be the leisure-time needs of people in Idaho.

The fourth problem was to review selected literature on community recreation programming. A questionnaire was developed and sent to the mayors of all first, second and third class cities to determine what they believed to be the needs of their communities for recreation services to be provided from the state level.

The fifth problem was to establish basic principles for the administration of state recreation services. These administrative principles were collected, developed and refined. They were then sent to a jury of experts for review. All statements were carefully screened and analyzed in terms of their contribution to the formulation of recreation administrative principles on the state level.

The sixth problem was to formulate recommendations for changing the organization, administration and cooperation procedures of state agencies in order to provide more effective recreation services in Idaho.

The investigator reviewed the implications of the data compiled, and correlated the recommendations with these findings.

Conclusions and Recommendations

In the final analysis, the study of recreation in Idaho resolved itself around three types of responsibilities concerning the administration of recreation on the state level. Recommendations have been formulated to provide enabling legislation for local communities to establish the kind of recreation services to meet their needs; to provide a permanent advisory recreation service at the state level to all types of governmental, private, and industrial agencies; to provide from the state level, recreation facilities such as parks, forest and game preserves, camp grounds, bathing beaches, picnic areas, and sport areas which can best be managed on this level.

393 pages. \$4.91. MicA 55-114

EDUCATION, PSYCHOLOGY

AN INVESTIGATION OF READING ACHIEVEMENT AS AN AFFECTIVE DETERMINANT IN THE PERCEPTION OF VERBAL AND NON-VERBAL SYMBOLS

(Publication No. 10,569)

William Strong Anderson, Jr., Ph.D.
Cornell University, 1954

PROBLEM

The purpose of the investigation was to determine the influence of reading achievement upon the perception of verbal and non-verbal symbols. Although inadequate skills and inattention are undoubtedly the causes for many cases of failure in word recognition, it was hypothesized that a failure to recognize words may be a defensive reaction against continued low achievement in reading. Under these conditions the words would serve as cues for a threatening situation and consequent blocking might be expected on the part of the individual. Since an avoidance reaction could reduce anxiety, and thus act as a reinforcing agent, it would tend to be habituated.

POPULATION

The subjects for the study were composed of eighth grade pupils who did not possess sensory dysfunctions in the areas of nearpoint visual acuity, exophoria, or auditory acuity. From this sample two achievement groups of thirty pupils each were selected with an equal number of males and females in both groups. An achievement index composed of reading ability and non-verbal mental ability was used for this purpose. The high achievement group contained pupils with relatively high reading ability and low non-verbal mental ability, while the low achievement group was composed of pupils with relatively low reading ability and high non-verbal mental ability.

PROCEDURE

Four different stimulus lists of thirty symbols each contained non-verbal symbols, consonant units, nonsense syllables, and three letter words. In this order the lists represented a progression from low familiarity in configuration and meaning to the words which represented stimuli with high meaning and familiarity for the reading situation. As the stimuli became stronger cues for the reading situation, it was expected that the differences between the achievement groups would become proportionately greater.

The stimuli in each list were presented individually for a duration of 100ms. by means of a pendulum tachistoscope. All stimulus lists were presented to the subjects in rotating order so that no group would be penalized by "warm-up effect".

CONCLUSIONS

1. The perception of symbols was specific to the nature of the symbols themselves with familiarity and meaning playing an important role in the ease with which symbols were perceived.
2. There was no evidence that high reading achievers are generally able to perceive symbols any more effectively than low reading achievers.
3. There were no greater differences between the perception of verbal and non-verbal symbols by the total group of subjects than between the verbal types of nonsense syllables themselves.
4. Consonant units were the only types of symbols that significantly discriminated between the achievement groups.
5. The mechanism of perceptual defense was not demonstrated within the design created for this purpose. Alternate interpretations, however, indicated that perceptual defense may have actually taken place.
6. No significant sex differences could be demonstrated in the perception of any of the symbols measured.

DISCUSSION

An analysis of the data revealed that the only significant differences between the achievement groups were to be found in the consonant units. These stimuli

were the most ambiguous of the verbal stimuli and hence were most likely to project the needs of the individual. In situations of moderate stress it has been found that the reaction to negative feelings, such as failure to achieve, is not to perceive the stimuli which serve as cues for the undesirable situation. Since the consonant units were the most unfamiliar and most likely to elicit a feeling of failure, the defensive reactions were most strongly in evidence. The other lists which were not as difficult showed proportionately fewer discrepancies.

151 pages. \$1.89. MicA 55-115

THE INFLUENCE OF PERMISSIVE CHILD REARING PRACTICES ON PERSONALITY DEVELOPMENT

(Publication No. 10,446)

Earl Edward Balthazar, Ph.D.
University of Illinois, 1954

The dissertation reviews and evaluates the theoretical assumptions and empirical data bearing on the popular doctrine that permissive child rearing practices benefit personality. Permissive behavior, on the part of the parent or adult involved, is defined as: (a) the relative degree of leniency or severity characterizing the limits of acceptable behavior set for the child; (b) the kinds of adult restraint or supervision exercised over the child's behavior; and (c) the relative degree of self-assertiveness permitted the child.

In this study, we advance the hypothesis that emphasis upon permissiveness reflects, in part, cultural ideals and socio-political values continuing from the historical past to the present. In treating the issue, we distinguish between two main categories of traits in a species with respect to the major source of control exercised over their development—phylogenetic traits, e.g., prehension or locomotion, upon which environmental factors have only slight influence, and ontogenetic traits, in which a relatively high degree of environmentally induced variability, as in the emotional, conceptual, and motivational aspects of behavior and in the development of personality.

From an historical viewpoint, the theoretical climate has not been favorable to the above conceptions of development. Theories of development having extensive influence upon educators and students of behavior have been largely predeterministic in orientation. Doctrinaire assertions of developmental predeterminism are found in Rousseau, Pestalozzi, and, to some extent, Froebel. These became the conceptual basis for permissive child rearing practices since they assumed that the only beneficial contribution of the environment to the ontogeny of behavior lies in providing a non-directive and unstructured habitat which permits optimal unfolding of the pre-charted course and sequential growth of the child. Extensions of this doctrine exist in Gesell's

conception of spontaneous maturation, in Hall's notions of cultural recapitulation and catharsis, as well as in Freud's schema of personality development organized around a prestructured sequence of psychosexual drives.

The belief that permissiveness is beneficial to personality is not supported in a comparative study of primitive cultures. A study of Manus society suggests that permissiveness does not necessarily lead to desirable personality outcomes, and that suitable child rearing practices should strive for continuity between childhood experience and the kinds of demands and expectations the child will face as an adult among his peers and associates. Such continuity would seem to be significant in the personality development of individuals in other primitive societies as well as in our own culture.

Because of the lack of psychological evidence bearing on permissive infant and child rearing practices, we have conducted a theoretical analysis of the influence of permissive child rearing on personality development. In terms of the rigorous expectations of middle-class Western society, our analysis has emphasized the importance of legitimate and reasonable parental regulation of the child's conduct and behavior, since his personality maturity must ultimately be judged in terms of his capacity to perceive his competencies, status, and role realistically at each stage of his development. In order to achieve these goals, parents must confront the child realistically and objectively (in accordance with his maturational level) with the realities that define his bio-social status at home in his culture.

The above views can only be accepted tentatively until experimental evidence is forthcoming. At the same time, the long history of cultural and ideological support for the doctrine of permissiveness and the dogmatism with which it has been propounded without convincing evidence obliges us to conclude that this aspect of social science theory moves in fads and cycles, as do customs, rather than because certain truths have been established by evidence or by the cumulative weight of logical inference.

117 pages. \$1.46. MicA 55-116

THE EFFECTS OF PERSONALITY AND GROUP ORIENTED FEELINGS OF SUCCESS AND FAILURE ON ASPIRATIONAL SHIFTS

(Publication No. 10,450)

Leonard S. Blackman, Ph.D.
University of Illinois, 1954

The purpose of this study was to analyze the effects, both single and combined, of personally and group oriented feelings of success and failure on the goal-setting behavior of a group of realistic aspirers. An attempt was made to determine the effectiveness of personal success or failure in producing aspirational shifts when this was all the information supplied to the aspiring subject. The findings from

this part of the study were then used as a base to evaluate the combined effects of personal success or failure and group success or failure in determining aspirational shifts when both of these pieces of information were presented contiguously. In addition, the study was designed so as to explore the possibility of sex differences in relation to all the relevant aspirational problems.

The experiment was set up, originally, as a two by two by five factorial design. One of the variables was sex, and the other dichotomized variable was personal experience (success versus failure). Under each of the two personal conditions were five group experience conditions ranging from what is defined as severe group failure through mild group failure, group equality, and mild group success to high group success. Later, to respect the assumption of homogeneity of variance, the severe group failure category was excluded from the analysis of variance. In addition, there were two control groups, one of which received only personal success information while the other received only personal failure information.

The sample consisted of 280 children, 140 boys and 140 girls, ranging in age from 9 to 13 and in grade placement from the fourth to the sixth grades at the Rantoul Elementary School, Rantoul, Illinois. Ten children were assigned to each of the twenty experimental conditions in the factorial design and forty children were assigned to each of the two control groups.

The task employed was a simple letter cancellation test. The performance score was reported in the number of seconds that the subject required to finish a certain amount of work. The subjects' levels of aspiration were also stated in terms of time scores.

It was hypothesized that a personal success experience, or a success in terms of one's previously stated level of aspiration, would raise the next level of aspiration while a personal failure experience would lower the next goal. It was further anticipated that when knowledge of a group standard was combined with information relating to personal success or failure, the former reference point would be effective in producing changes in aspirational shifts only after a failure experience in relation to the group norm.

An overall conclusion which may be drawn from the results of this study is that when an individual has available both personal and group reference points as a guide in setting later goals, the effect of the group variable will be additive to that of the personal variable only under conditions of group failure. There is a decay effect of the group reference point under conditions of group success with the individual using only his personal frame of reference as a guide in setting goals. The relative saliency of the group frame of reference in determining aspirational shifts with group failure, and its decay with group success, portends a hyperbolic relationship between aspirational shifts and the combined personal-group conditions, which the data support tentatively rather than conclusively.

Neither in reaction to the personal success or failure situations, nor in response to the combined personal-group conditions did sex differences appear

to exert a differential effect upon aspirational shifts. 86 pages. \$1.08. MicA 55-117

THE EFFECT OF AN EXPERIMENTAL COURSE IN GEOMETRY ON ABILITY TO VISUALIZE IN THREE DIMENSIONS

(Publication No. 10,454)

Francis Robert Brown, Ed.D.
University of Illinois, 1954

The problem of this study is to test the hypothesis that there is no significant difference in spatial visualization (as measured by the Space Relations Test of the Differential Aptitude Series) between pupils who study the usual two-year mathematics sequence of plane geometry, advanced algebra, and solid geometry, and the pupils who study a one-year course that combines elements of plane geometry and solid geometry.

Included in this hypothesis is the implied assumption that it is possible to improve significantly a person's ability in spatial visualization by selecting for study certain subject matter usually taught in solid geometry.

To test the hypothesis two groups of pupils were used. The control group was a group of pupils who elected a two-year sequence in plane geometry, advanced algebra, and solid geometry. The pupils were sophomores at the beginning of the two-year sequence. The experimental group was a group of sophomores who elected plane geometry. They were taught an experimental course of plane geometry combined with certain elements of solid geometry.

The method of covariance analysis was used to make the groups comparable on mental age and pre-course spatial visualization. The variable effects due to school factors and to social and environmental factors were reduced by using groups from the same school. The hypothesis was tested by comparing the final scores on spatial visualization.

Two additional hypotheses were tested. The first of these was the hypothesis that there is no significant difference in the ability in spatial visualization between pupils who have completed a year of plane geometry and comparable pupils who have completed a one-year course of plane geometry fused with elements of solid geometry. The second of these hypotheses was that there is no significant difference in achievement in subject matter commonly taught in plane geometry between pupils who have completed a year's course in plane geometry and pupils who have completed a one-year course of plane geometry fused with elements of solid geometry. Experimental and control groups were located in each of two schools. A total of 423 pupils was used in the study of the three hypotheses.

The study demonstrated that the main hypothesis was rejected. The pupils in the experimental group did not gain as much in ability in spatial visualization as the two-year plane-solid control group. The control group did significantly (at the 1% level) better than the experimental group.

The second hypothesis tested concerned the gains in ability in spatial visualization by two one-year groups. One group studied plane geometry and the other group studied the plane geometry fused with solid geometry. This hypothesis was tested by data from two different schools and the results were in conflict. In one school the difference between the groups was significant and in the other it was not. However, in each case the plane geometry group made a greater gain than did the experimental group.

Testing the third hypothesis showed that there was no significant difference in the post-course scores in plane geometry achievement (using Cooperative Plane Geometry Test, Form Z) between the control and experimental groups.

There was some evidence that studying the experimental course might have caused the pupils to become slower and more cautious in taking the Space Relations Test. However, it was evident that the assumption that the study of the solid geometry content fused with plane geometry would increase the ability in spatial visualization (as tested by the Space Relations Test) was not valid.

88 pages. \$1.10. MicA 55-118

A STUDY OF THE RELATIONSHIPS AMONG CERTAIN OCCUPATIONAL GROUPS IN PERFORMANCE ON THE DIFFERENTIAL APTITUDE TEST BATTERY

(Publication No. 10,428)

Robert Collier Hall, Ph.D.
University of Connecticut, 1954

This study was done for the purpose of providing information that might be of aid to counselors when assisting youth to make vocational choices. The need for valid clues for assisting youth to make occupational choices is always of paramount concern to the guidance counselor. The primary question raised in this study was: "Do occupational groups tend to be characterized by the Differential Aptitude Test battery performances of individuals classified as belonging to these groups?" The experimental design used for obtaining an answer to this question centered about Joseph G. Bryan's¹ mathematical generalization of R. A. Fisher's two-group discriminant function called multiple discriminant analysis. This technique states the problem of group characterizations in terms of three questions. These questions are: (1) Do the distributions of test scores of each occupational group occupy different regions of multi-test space? (2) If so, how many dimensions of the discriminant space are necessary to account for group separations? and (3) Can probability statements be derived for the purpose of indicating that a given set of test scores in the discriminant space could have been drawn from each occupational group distribution?

A study was made of 287 boys who, prior to graduation from high school in 1947, took all eight of the Differential Aptitude Tests published by the Psychological Corporation of New York City. After graduation,

these same individuals followed their inclinations in finding gainful employment or attending a liberal arts college. Two years later these same individuals were classified into six groups by means of criteria used in a follow-up study² made by the Psychological Corporation in 1950 and 1951. The male groups were identified as liberal arts, clerks, salesmen, skilled, unskilled, and the mechanical, electrical, and building trades.

The general technique of multiple discriminant analysis applied to the data for the 287 males indicated that nearly all of the information concerning the separation of the six groups is provided by one linear combination of the eight tests of the Differential Aptitude Test battery. The other discriminants found were regarded as having minor importance for separating groups as they accounted for such a small percentage of the total variance. The one discriminant function used appears to be a combination of two general factors, viz., verbal ability, and speed of perception at routine tasks. The evidence supports an hierarchical classification of occupations based on these two factors.

Discriminant scores were computed for each of the 287 individuals. A test for normality of discriminant score distributions demonstrated that the assumption of normality was tenable for all groups except the skilled group. The deviation from normality for this group was regarded as not seriously affecting the interpretation of discriminant scores for the purpose of individual advisement.

Centour scores³ were computed on the basis of the discriminant score distributions for each of the six groups. The centour scores are the probabilities that a given discriminant score comes from one of the six groups.

The means of the discriminant score distributions for the clerks, salesmen, and skilled groups indicate very little separation and therefore appear to represent a family of occupations in terms of their Differential Aptitude Test performances. By the same token, the mechanical, electrical, and building trades and unskilled groups evidence a family relationship. The greatest separation was between the liberal arts college group and the unskilled occupations.

The centour scores are regarded as helpful information in spite of the great amount of overlap in the discriminant score distributions. A model for interpretation of centour scores is presented.

171 pages. \$2.14. MicA 55-119

1. J. G. Bryan, "A Method for the Exact Determination of the Characteristic Equation and Latent Vectors of a Matrix with Applications to the Discriminant Function for More Than Two Groups," pp. xi + 292. Unpublished Ph.D. dissertation, Graduate School of Education, Harvard University, 1950.

2. George K. Bennett, Harold G. Seashore, and Alexander G. Wesman, "Aptitude Testing: Does It 'Prove Out' in Counseling Practice?" Occupations, XXX (1952), pp. 584-593.

3. D. V. Tiedeman, J. G. Bryan, and P. J. Rulon, The Utility of the Airman Classification Battery for Assignment of Airmen to Eight Air Force Specialties, pp. xii+328. Cambridge, Mass.: Educational Research Corporation, June, 1951.

THE PREDICTION OF ACADEMIC SUCCESS OF FRESHMEN IN A COMMUNITY COLLEGE

(Publication No. 6299)

Donald Warren Kern, Ed.D.
New York University, 1953

Chairman: Professor Brian E. Tomlinson

The problem and its importance

The problem was that of determining the effectiveness of certain measures or combinations of measures of certain tests of mental ability and academic performance as predictors of academic success at the University of Bridgeport. This problem is important because of the necessity of making studies of this sort in privately supported community colleges.

The historical and theoretical background of the problem

Other studies have dealt with various types of colleges, but the area of the privately supported community college has received little attention in the literature. No study of admissions procedures had ever been made at the University of Bridgeport.

Such factors as high school performance and scores on various tests have been combined through multiple correlation to yield a multiple regression equation upon which prediction has been based. These studies usually base prediction upon the grades earned at the end of the first marking period although a few studies have used a period of one year or more.

The procedure in collecting data and types of data collected

Two groups of students were used: 368 students admitted in 1950, and 260 students admitted in 1951. Data collected from the secondary school included average, percentile rank, and principal's recommendation. Students took Aptitude and Placement Tests which yielded scores on the following: 1948 College Edition of the ACE, the Cooperative English Test, the SRA Reading Record, the Cooperative Elementary Algebra Test, and the Kuder Preference Record. From information on file in the Records Office came the Residence Hall Rating and the quality point ratio.

The results

The most significant relationships were found between high school record and quality point ratio, scores on the English Test and quality point ratio, and the Comprehension Section of the SRA Reading Record and quality point ratio.

The data were treated by multiple correlation techniques and an R of .674 was developed using as the variables quality point ratio, total scores on the ACE and the Cooperative English Test, the Comprehension Section on the SRA Reading Record, and percentile rank. The multiple regression is: $X = -.713 - .004X_2 + .145X_3 + .012X_4 + .007X_5$. This equation was found to predict within .67 of the true earned quality point ratio.

The regression equation was tested by predicting the quality point ratio for the 1951 group and correlating it with the quality point ratio actually earned. A r of .486 resulted.

A cut-off point of 1.8 based upon the predicted quality point ratio was found to yield the most acceptable results with a success ratio of 27 per cent and a rejection rate of 35 per cent.

An empirical method was developed to screen residence hall students. Overachievers who scored above the ninetieth percentile on two or more of the three Kuder areas (Social service, clerical, musical) were found to be problems in the dormitory.

Conclusions

This study confirmed the consensus of predictive studies that high school record is the best indicator of probable success in college. The regression equation will provide the University of Bridgeport with a more effective means of selecting students than the present method.

Recommendations

Further study is needed to determine whether first semester grades provide the best basis for prediction.

Since the method used to screen residence hall students is based upon a small group, further study of the Kuder should be made to determine its value as a personality measure.

157 pages. \$1.96. MicA 55-120

STABILITY AND CHANGE OF MEASURED VOCATIONAL INTERESTS OF HIGH SCHOOL STUDENTS

(Publication No. 10,119)

Raymond Arthur McCoy, Ed.D.
University of Missouri, 1954

Supervisor: Paul C. Polmantier

Purpose: To investigate the nature of change and stability of measured vocational interests of high school students.

Methods of procedure: Using the Kuder Preference Record (Vocational) Form C, and treating the sexes as separate groups, an attempt was made to derive stability scales in order to assess interest stability within the individual; an analysis was made of the testing instrument itself in order to assess stability of results inherent in components of the test; a statistical comparison was made of test-retest results for groups of high school students differing with respect to sex, grades involved in test-retest, and interval of time between tests.

Summary:

(1) Test results were obtained for high school students who had taken the Kuder Preference Record (Vocational) twice with a time interval of approximately two to three years intervening between testings. According to the degree of consistency of interests from test to retest, the

profile sheets were classified by competent judges as belonging in a "change", "stable", or "doubtful" group. The latter category was employed when the profiles could not definitely be placed in either of the other categories. Stability scales were then constructed by comparing the responses of the change and stable groups on the initial tests. A response category was chosen for the scale if the percentage of students in the change and the stable groups marking the response was significantly different at the 10 percent level of statistical confidence. Eighty-four response categories for the boys and 89 for the girls met the above criteria and were selected for the stability scales.

(2) Comparable test data were collected for new groups of students in order to cross validate the stability scales. These data were processed in the same manner as before and the profile sheets were placed in change, stable, or doubtful groups by the same judges. When the stability scale scoring keys were tried out on the new groups of students they did not satisfactorily differentiate between the change and stable groups. Validity was not established for the scales on either the male or female groups.

(3) Test-retest results for homogeneous samples of the change and stable groups were compared in order to determine relative stability among the ten scales of the test. For the boys, means and standard deviations on the Artistic scale were very comparable between the change and stable groups and the correlations were very similar and reasonably high (.792 and .839). Similar comparisons were made in terms of percentages of retest scores falling into the original percentile categories. These comparisons indicated that of the changes which occurred on the ten scales of the test, very little had occurred on the Artistic scale. The Artistic scale for the boys appeared to be a relatively highly stable scale. For the girls, none of the interest scales was outstanding with respect to interest stability.

(4) The stability of scores falling at the extremes of the distribution, as against the stability of scores falling in the middle areas of the distribution, was compared in terms of the percentages of retest scores falling again into the same percentile category as had the initial test scores. Very high or very low percentile scores were appreciably more stable than middle scores. Scores well above the 75th percentile and well below the 25th percentile seem necessary for reasonable assurance of stability of measured vocational interests.

(5) In comparing test-retest results, the outstanding characteristic of interest change appeared to be a shifting of rank within the group. Gross changes in mean scores or in variability were not prominent.

(6) The amount of change of measured vocational

interests of high school students tested in the ninth grade and again in the eleventh grade did not differ appreciably from the amount of change for students tested initially in the 10th grade and again in the 12th grade.

Recommendation:

(1) That whenever possible, successive testings be employed with the Kuder Preference Record (Vocational) particularly for students whose initial scores are not at either extreme of the particular scale distribution.

214 pages. \$2.68. MicA 55-121

DEVELOPMENTAL PATTERNS OF MONGOLOID CHILDREN: A STUDY OF CERTAIN ASPECTS OF THEIR GROWTH AND DEVELOPMENT

(Publication No. 10,514)

William Duncan Davidson McNeill, Ph.D.
University of Illinois, 1954

The purpose of the study was to investigate the pattern of development of mongoloid children. Specifically, the study attempted to secure information which would answer the following questions:

1. Do the different aspects of the growth of mongoloid children form a significant pattern?
2. Are the developmental patterns the same for institutionalized and home reared mongoloids?
3. What developmental ages are reached in weight, height, strength of grip, mental growth, social maturity, vocabulary development, and motor coordination by institutionalized mongoloids at the chronological ages of three, six, nine, twelve, and fifteen years?
4. What are the developmental ages attained by mongoloid children of similar chronological ages reared at home?
5. How do the developmental ages of these two groups of mongoloids compare?

The general method employed in the study was the cross-sectional normative-survey. Two groups of mongoloid children were selected for study. The institution group comprised the 79 mongoloids in two state institutions in Illinois who were within six months of their third, sixth, ninth, twelfth, and fifteenth birthdays; and who had been institutionalized for at least two years. The home group included 24 nine-, twelve-, and fifteen-year old mongoloids enrolled in five parent sponsored classes in and near Chicago.

Measurements of weight and height were obtained for all subjects. The Vineland Social Maturity Scale and The Kuhlmann Tests of Mental Development were also administered to the total group. The following tests were administered only to those six years of age and over: The Arthur Adaptation of the Leiter International Performance Scale, The Van Alstyne Picture Vocabulary Test, The Moore Eye-Hand

Coordination Test, and a hand dynamometer strength of grip test.

The physical measurements and test scores were converted to developmental quotients which were utilized to compare the different aspects of growth within each of the two groups of mongoloid children. The development of the institution and home groups was also compared.

The major conclusions with respect to the mongoloid children studied were as follows:

1. The relative degrees of development of mongoloid children in the seven aspects of growth measured form significant patterns which differ from the normal pattern of growth.

2. The degree of social and vocabulary development of the home reared children was greater than the degree of motor development. In the institution group motor development was greater than social and vocabulary development. The developmental pattern of the home group is, thus, different from that of the institutionalized children.

3. Mongoloid children are more adipose than they are tall.

4. Development in stature is greater than development in muscular strength.

5. The degree of development in muscular strength is greater than the degree of social, mental, vocabulary, and motor development.

6. Social development exceeds mental development.

7. Existing instruments for the measurement of the vocabulary of severely retarded children are inadequate.

8. The majority of mongoloid children between the ages of three and fifteen years are classifiable as idiots (I.Q. below 25).

9. Mongoloids in special classes are unlikely to profit from academic instruction. The emphasis in such classes should be placed upon training in the social skills essential to acceptability in the home.

10. Mongoloids are unlikely to achieve success in the performance of tasks which involve other than gross motor control.

The home reared mongoloids were found to be superior to the institution children in all the aspects of growth measured. It was suggested that this result may have been due to one or both of the following factors: selective institutionalization, and (or) environmental differences.

138 pages. \$1.73. MicA 55-122

CHARACTERISTICS OF JUNIOR COLLEGE WOMEN HAVING PERSONAL PROBLEMS HINDERING ADJUSTMENT

(Publication No. 10,130)

Leland Thorpe Rodgers, Ed.D.
University of Missouri, 1954

Supervisor: Paul C. Polmantier

Purpose: This is a study of junior college women who required the help of the Psychological Counseling Service of Stephens College, Columbia, Missouri, with problems of personal adjustment, made in comparison with a control group of women who succeeded without special help. The study seeks answers to the following questions: What do the data reveal about the group which sought the help of the Psychological Counseling Service? What differences exist between the two groups of students? How significant are the differences between the groups?

Methods of Procedure: The findings and conclusions of this investigation are based on content analyses of personnel data and information obtained in counseling interviews, as well as upon statistical analyses of differences between the groups of students.

Summary:

Results indicate that difficulties of interpersonal relations in the home and family, peer relationships, physical manifestations of emotional problems, and physical findings affecting health status were the main psycho-socio-biological factors hindering adjustments in college.

Significant group differences, favoring the "no-problem" group over the "problem" group, were obtained on scholastic achievement; emotional development; and on psychological test data related to college aptitude, proficiency in reading skills, and aptitudes found important for success in many occupations. Also significant were differences in age between siblings, broken homes hindering adjustment, social development, personal freedom of social interaction, dating experience, summer camp and counselor experience, work experience, citizenship in high school and college, extra-class participations, recommendations for college entrance, and on the number of subjects dropping out of college. Significant group differences were found on general health status, physical examination findings prior to college entrance, and on systemic disturbances affecting subjects' health condition while in residence at the college.

In general, expressed preferences for certain occupations and certain measures of personality components did not differentiate between the groups. Significant group differences were not obtained in age of parents, their financial status, occupations, or educational level; in subjects'

church affiliations; in the size of high school graduating classes, population of home communities, or in geographic distribution. Also lacking in significance were group differences in number of childhood diseases, accidents, operations, and severe illnesses; and in menstrual histories.

Conclusions:

The findings seem to justify the following conclusions: That personnel data can be used to differentiate between subjects used in this investigation who demonstrated "good" and "poor" adjustment in a college situation. That the generally poor personal adjustments and low academic standing of the subjects can be attributed to emotional interference of personal problems more than to any lack of ability or aptitude for college work. That difficulties of personal adjustment in college appear more related to parent child treatment than to the number of children, position within the family, or to differences in age between siblings. That physical health factors played a large role in the personal adjustments of subjects in the "problem" group and that medical information merits careful analysis in the selection of applicants for admission to college. That improvement or stabilization of personal adjustments appears to be a factor in the improved academic performance of the "problem" group during the second year in residence in the college. That this investigation indicates the need for a reliable and valid technique of determining emotional, social, and motivational status both as preadmissions data to be used in the screening of applicants and for the prediction of probable maladjustment among students admitted to the college. 467 pages. \$5.84. MicA 55-123

AN EXPLORATORY STUDY OF A PARENT-SPONSORED DAY SCHOOL FOR SEVERELY MENTALLY RETARDED CHILDREN

(Publication No. 10,565)

Morvin Albert Wirtz, Ed.D.
University of Illinois, 1954

The purpose of this pilot study was to determine the consequences of a day school program for twelve severely mentally retarded children and their parents in terms of behavior changes in the children and attitudinal changes in the parents over a one-year period. An attempt was also made to determine the characteristics of severely mentally retarded children that indicate capacity for training.

The procedure used was as follows: (a) Psychometric and social maturity tests were administered at the beginning of the school year and repeated at the end of the year. (b) A Behavior Check List was developed on which the children were rated by the teachers and the parents in the fall and again at the

end of the year. (c) A Directed Interview was developed that was used with the parents to determine changes in their attitudes toward the school, the community, the family, and life plans for the children over a one-year period. (d) Additional information about the children and their parents was obtained through a social history secured by a social worker and behavior journals on the children recorded by the teachers during the school year.

The major tentative conclusions are as follows:

1. Psychometric retests after one year of school attendance showed essentially no change in the intelligence quotients of the children.
2. The results obtained from the Vineland Social Maturity Scale were inconsistent, indicating a limited usefulness of this gross instrument for measuring both social maturity and progress of the children.
3. The children made the most progress on the following twelve of the twenty-one items on the Behavior Check List: (a) eating, (b) drinking, (c) undressing, (d) dressing, (e) washing hands and face, (f) brushing teeth, (g) proper use of clothes, (h) putting away toys, (i) general housekeeping, (j) isolated play performance, (k) group play performance, and (l) receptive language.
4. The teachers' ratings indicated that six of the twelve children made significant improvement in behavior as measured by the Behavior Check List.
5. It appears that trainability is related to a mental age of three years or above and an intelligence quotient of thirty or more on the Stanford-Binet (form L) test and the Ontario School Ability Examination, and a median rating by the teachers of three or more on the Behavior Check List.
6. Parents tend to rate their children at a higher numerical level on the Behavior Check List than do the teachers at the beginning of the school year, but closer to the teachers at the end of the school year.
7. The attitudes of the parents toward the school, the community, the family, and life plans for the children, revealed by the Directed Interviews, were used to suggest twenty-two hypotheses for further study of the family dynamics resulting from having a severely mentally retarded child in the home.

It was suggested that a new organization may be needed that will provide the benefits of both community day schools and institutional placement. Such an organization would be in essence a community center which would be likely to have fewer drawbacks than either large state institutions or day schools located in the community.

318 pages. \$3.98. MicA 55-124

EDUCATION, TEACHER TRAINING

LISTENING COMPREHENSION AT
CONTROLLED RATES FOR CHILDREN
IN GRADES IV, V, AND VI

(Publication No. 10,108)

Geraldine Katharine Fergen, Ed.D.
University of Missouri, 1954

Supervisor: A. Sterl Artley

PURPOSE: To determine the effect of rate of oral presentation on listening comprehension in terms of grade level, mental age, chronological age and intelligence.

METHOD OF RESEARCH: The materials for the normative-survey were presented in a standard manner from phonographic recordings at rates of 80, 130, 180 and 230 words per minute. The Iowa Every-Pupil Tests of Basic Skills, Test A, Elementary Battery, Grades 3, 4, 5, Silent Reading Comprehension, was chosen as the best available measure of comprehension and the four equivalent forms were adapted for presentation at the four selected rates of speed. By use of recordings the materials were presented to 438 children enrolled in five public schools in Missouri. Machine scored answer sheets furnished basic data for making statistical analyses.

SUMMARY AND CONCLUSIONS:

1. Within the limits of 50 word increments, from a speed of 80 words per minute to a speed of 230 words per minute, the speed of 130 words per minute effects the highest listening comprehension; a speed of 80 words per minute effects higher listening comprehension than speeds of 180 and 230 words per minute.
2. In terms of grade level, mental age, and chronological age there is an increase in listening comprehension from a speed of 80 words per minute to a speed of 130 words per minute and a decline with speeds of 180 and 230 words per minute.
3. The ability to comprehend material presented orally, at the rates used in this study, showed a gradual growth, from grades IV through grade VI; in annual increments of mental age from mental age 9 through mental age 14; and in annual increments of chronological age from chronological age 10 through 12.
4. Though brighter children comprehend more at each rate of oral presentation than do children with lower intelligence there are no differences between the groups in the pattern of rate superiority. The more intelligent show greater comprehension ability at the fastest speed than the less intelligent do at the slowest speed. This difference, however, may be

spurious in light of the fact that the slow speed may have impeded comprehension.

5. Intelligence appears to have a positive relationship to listening comprehension at each rate of oral presentation used in this study. However, at no rate of oral presentation does the relationship appear substantial enough to justify the use of an intelligence test as an instrument for the prediction of listening comprehension.

193 pages. \$2.41. MicA 55-125

A PROPOSED CURRICULUM FOR PREPARING
TEACHERS OF MUSIC AT
KEARNEY STATE TEACHERS COLLEGE

(Publication No. 10,493)

Robert William House, Ed.D.
University of Illinois, 1954

This study is concerned with curriculum proposals for the preparation of school music teachers, as a basis for changing the current program at the Nebraska State Teachers College at Kearney. Useful implications are claimed for the study in terms of the general development of music teacher education.

From the fields of educational philosophy and psychology principles are derived and applied to the structuring of the curriculum. Objectives for the program are established through study of the responsibilities of music teachers in carrying forward the function of music in the public schools and in society. Using these objectives as focal points, experiences are identified through study of the nature of educative experiences and their exemplification in various curricula. In planning to evoke such experiences, the program is outlined in terms of the guidance of instruction, sequence, areas of study, provisions for differentiation, and procedure to be followed in planning the course of study; these arrangements largely devolve from the nature of the philosophical and psychological principles, the objectives, and the experiences already established. The music students, teaching graduates, and staff at Kearney State Teachers College were contacted by questionnaire, for specific information as to the pre-college and teaching experience of music students, and as a means toward developing staff consensus and implementation of the curriculum proposals.

It has been found that the curriculum for music teacher preparation rests upon the needful purposes of society and the individual, and the inherent nature of music. Music is used symbolically, as expressive of concepts untranslatable into discursive form. Human response to tone is universal, and thus music is an ineradicable part of all cultures; music teachers should be prepared to bring the expressive value of music to all.

The curriculum is formed in terms of objectives

which define the well-qualified music teacher. Musical, teaching, and social competencies are isolated and discussed; the valid purposes of the music teacher may be fulfilled by his exercise of such specific knowledges and skills, appreciations, attitudes and understandings.

Reorganization of the music student's behavior must be accomplished by means of experiences, directed through the teacher's manipulation of the learning environment and his observation of the student's interaction with that environment. Such experiences are described as should combine to produce the desired outcomes.

The activities in which music students engage do not define the experiences which are had. The student's experience is determined by his purposes and his perception of the conditions in which he is placed; units, activities, methods and materials must be planned in terms of the student's purposes and the functional solution of his problems. Description is made of the progression of student experiences through exploration and generalizations in the art of music, to the direct application and testing of the student's acquired knowledge. Such a process can be fostered by division of the program into broad areas—of musical performance, theory, literature, and pedagogy—taught in terms of a laboratory-workshop approach. 170 pages. \$2.13. MicA 55-126

A STUDY OF THE RELATIONSHIP BETWEEN METHODS OF TEACHING A COLLEGE COURSE IN MENTAL HYGIENE AND CHANGE IN STUDENT ADJUSTMENT STATUS

(Publication No. 10,610)

Gustave Bernhardt Timmel, Ph.D.
Cornell University, 1954

Purpose of the Study

The primary aim of this investigation was to discover whether change in personal adjustment, as measured by the Minnesota Personality Scale, occurs among a group of college upperclassmen as a result of completing a course in mental hygiene. Moreover, the relative effectiveness of the lecture and project methods in implementing a change was to be determined.

Methods and Procedures

Two classes in mental hygiene, assigned to a single instructor, were selected as the groups to be studied. These groups were made up of upperclassmen and women. A third group, made up of students who had never been enrolled in a mental hygiene course was selected by random methods from the student body. Seven men and seventeen women from each of these groups were matched on the basis of their initial scores on the Minnesota Personality Scale. Administering this Scale at the completion of the semester yielded scores from which score gains were computed for each group.

The means and standard deviations of initial scores and control variables were determined. The latter consisted of age and year in school, which were treated as age in months and credit hours completed, respectively. (Sex as a control variable was held constant by statistical means.) These procedures were repeated until adequately homogeneous groups resulted. That course major was not a relevant factor was determined in a preliminary study in which two groups drawn from the control group were equated on the basis of initial criterion scores. Adjustment gain scores made by these groups were subjected to analysis of covariance.

One of the two experimental groups was taught by a lecture method, the other by a project plan of teaching. The group selected from the student body served as a control group. All were tested at the beginning and again at the end of the semester. Gains in score on the five parts of the Minnesota Personality Scale represented the criteria.

By means of analysis of covariance the significance of the differences in score gain means was determined. Furthermore, determining the significance of sex differences was possible with this method.

Student and instructor questionnaires were the two major checks on the methods actually employed by the instructor. These were supplemented by interviews between the researcher and the instructor, and notes on classroom events by the latter.

Results

Among the findings of this investigation were the following: (1) No statistically significant gain in adjustment status, as measured by the Minnesota Personality Scale, occurred as a result of the course in mental hygiene; (2) neither the lecture method nor the project method of teaching was found to be superior with respect to their influence on the scores made by the two classes; (3) men did not differ from women in regard to their capacity to improve in adjustment status; (4) students whose major was Physical Education did not significantly differ, statistically, from those majoring in Elementary Education, with respect to their ability to gain in personal adjustment status.

Conclusions

The following conclusions are delimited to a teachers college population made up of upperclassmen and located in New York State.

1. A course in mental hygiene taught to a large group of upperclassmen does not tend to result in personal adjustment gains which are measurable by the Minnesota Personality Scale.
2. Neither the lecture nor the project method of teaching, when employed by the same instructor, is superior in achieving improved personal adjustment among groups of this nature.
3. Men and women do not differ in their capacity to improve in personal adjustment.
4. Students of Physical Education do not differ from students of Elementary Education with respect to their ability to gain in personal adjustment status.

149 pages. \$1.86. MicA 55-127

EDUCATION, THEORY AND PRACTICE

A COMPARISON OF CONCEPTIONS OF
THE ROLE OF THE TEACHER OF
VOCATIONAL AGRICULTURE

(Publication No. 10,444)

Mostafa Kamel Badran, Ph.D.
University of Illinois, 1954

In order to compare conceptions of the role of the teacher of vocational agriculture in the Central Region with reference to autism, absolutism and reciprocity, these terms were defined and given with lists of concepts to jury members for validation.

Three agricultural education groups (namely, beginners, seniors and high-school teachers), three "agriculture" groups (namely, beginners, seniors and farm advisers), and teacher trainers responded to three forms (namely, disagree-agree, two-choice and three-choice forms). Coefficients of correlation were computed for scores of the first form. Coefficients of internal consistency, analysis of variance and "t values" were obtained for the three forms.

It was found that, in general and within the assumptions and limitations of the study, as an individual progresses in his agricultural education, he develops gradually from autism to absolutism, and, then, to reciprocity. Compared to the change that takes place among the "agriculture" groups, the change among the agricultural education groups is, evidently, faster.

102 pages. \$1.28. MicA 55-128

PRACTICES AND OPINIONS RELATIVE TO
PRACTICAL ARTS EDUCATION FOR MENTALLY
RETARDED SECONDARY SCHOOL YOUTH

(Publication No. 10,124)

Alfred Henry Moore, Ed.D.
University of Missouri, 1954

Supervisor: H. H. London

Purpose of Study: The purpose of this study was to bring together information on present practices and opinions relative to practical arts education for mentally retarded secondary school youth, and to analyze the data to ascertain what implications these practices and opinions might have for implementing such programs.

Sources of Data: Data were secured by information from administrators and teachers of practical arts for mentally retarded youth in 30 states for the school year 1952-53. Data concerning practices and opinions were obtained from 154 administrators. Data concerning opinions were obtained from 341 teachers, of whom 153 were selected as meeting minimum qualifications for the study. The 153 teachers were divided into three

equal groups on the basis of qualifications, only those opinions of the 51 best qualified teachers being used in the interpretation of data.

Summary: A majority of administrators and teachers agreed that "the commonly accepted objectives of education apply alike to mentally retarded and normal youth".

All teachers and most administrators agreed that "the means of attaining educational objectives will differ with mentally retarded and normal youth".

Most teachers, and about three-fourths of the administrators, agreed that "practical arts activities should be given more occupational emphasis for mentally retarded than for normal youth".

The most common, and most favored, practical arts class placement for mentally retarded youth was "some in segregated classes". "All in segregated classes" received considerable favor.

Practice and opinion favored common use of practical arts facilities by mentally retarded and normal youth.

Two-thirds of the practice in supervision of mentally retarded youth in practical arts was by both practical arts and special education supervisors, three-fourths of such supervision being correlated. A bare majority of teachers and almost three-fourths of the administrators agreed to using both supervisors and correlating their supervision.

In the opinion of respondents, the 13 through 15 year age group should devote about one-third of their school time, and the 16 and over age group about one-half school time, to practical arts.

Average, minimum, and ideal practical arts class sizes for mentally retarded youth were, respectively, 17.6, 11.1, and 13.3.

Emphasis in homemaking for mentally retarded youth should shift from foods and clothing to general homemaking. Emphasis in industrial arts should be on home mechanics, followed closely by arts and crafts and general shop. There should be a considerable increase in occupational information, part-time and cooperative work programs. Stress in business training should be on personal needs. The greatest emphasis in agriculture should be on general agriculture. Development of low skill occupations should have a place in all practical arts areas.

About one-half of the schools having federally reimbursed vocational education classes were accepting selected mentally retarded youth. Few disagreed to accepting them, but there was much indecision.

Two-thirds of the schools cooperated with the vocational rehabilitation service relative to mentally retarded youth, few disagreed to cooperation, but availability of service seemed limited.

Little use had been made of well-planned job surveys and follow-up studies in practical arts curriculum adjustment for mentally retarded youth.

Post-school training for mentally retarded youth was the most neglected, yet one of the most desired, occupational training possibilities studied. Fourteen per cent of the schools provided such training, 71 per cent agreed that it should be provided, and only 8 per cent disagreed.

The most important criteria in selection of practical arts courses and course content for mentally retarded youth were: occupational information, safety-health instruction, ability of students, mental age, interest of students, personal-social development, and attitude-habit development. Importance varied with use - selecting courses as against content.

Practical arts teachers of mentally retarded youth used teaching aids and techniques considerably more or less than the value attached to them. Aids and techniques used more than valued were: bulletin board, charts and posters, group demonstrations, working drawings and diagrams, textbooks, and a grading system. Those used less than valued were: films, slides, planning with other teachers, field trips, and teacher-made instruction sheets. The use of individualized instruction and concrete materials were decidedly favored, as compared with group instruction and abstract materials.

211 pages. \$2.64. MicA 55-129

PRINCIPLES OF METHOD IN GROUP STRING INSTRUMENT INSTRUCTION

(Publication No. 10,546)

John William Shepard, Ed.D.
University of Illinois, 1954

The purpose of this study is to derive, logically, principles of method for effective group string instrument instruction and to apply these principles to the teaching of string instruments in the public schools.

Many of the problems that arose from the attempt of the schools to incorporate instrumental instruction into their curricula have not yet been solved. The need exists for the formulation of principles for teaching that are rooted in present day educational philosophies and procedures and for revitalized teaching programs of string instruction in the schools.

The hypothesis is proposed that principles of method for group string instruction can be formulated through an analysis of the general and musical objectives of the public schools, through application of learning principles to the problem, and through a consideration of the expressive elements of music and their significance for string class methodology.

As a first step immediate and long range objectives are established for the string class. They evolve from the consideration of the string class as an integral part of the school music program and from a consideration of the special contribution that the string class can make toward realizing the general objectives of the school and the objectives of the

music program. The general educational objective on the highest logical level selected as the starting point for this study are those proposed by the Educational Policies Commission of the National Education Association. In terms of the social and educational aims thus established and in accordance with guiding principles proposed by authoritative sources in the field of music education, objectives of the music program in the public schools are formulated. From this background the immediate and long range objectives for the string class evolve. The string class objectives also provide for the playing needs of the student in their recognition that the development of playing skills represent legitimate goals in themselves. In this way the string class objectives fulfill the two-fold function of an interactive educational philosophy as applied to string teaching, namely, the obligation of the learner to society and its values, and the obligation of society to make provision for the individual to develop his highest potential in whatever area his ability lies.

Chapter III presents an analysis and synthesis of current learning theories. General principles of learning are derived for later use in the establishment of principles of method for the string class.

The expressive elements of music and human reaction to music are considered in Chapter IV. The significance of the findings in these areas is summed up in the statement of guiding principles later utilized as additional significant factors contributing to the formulation of principles of method for string class instruction.

In Chapter V twelve teaching principles for group string instrument instruction are formulated that have been developed from the research in the areas described previously. The principles are presented as guides for the organization and direction of the group string learning in the public schools. They are intended to cover all aspects of group string methodology including:

1. Types of musical activity in the class.
2. Musical growth through the class activity.
3. Development of performing skills in the class.
4. Developmental sequence of the learning in the class.
5. Evaluation of individual growth.
6. Provision for individual differences.
7. Rapid initial development of basic skills.
8. Development of skills through their application to musical expression.
9. Technical drill in the string class.
10. Developmental reading skills.
11. Use of materials.
12. General organization of the class for the utilization of the unique benefits that group instruction offers to string instrument learning.

Each principle is analyzed and discussed for the purpose of making clear its value to the string class teacher. Illustrative examples or suggested techniques for the application of the principles to string class teaching are included.

168 pages. \$2.10. MicA 55-130

THE FORMULATION OF A RESOURCE UNIT OF
TEACHING AIDS FOR THE INDUSTRIAL ARTS
WOODWORKING SHOP ON THE
HIGH SCHOOL LEVEL IN NEW YORK CITY

(Publication No. 9329)

Oscar Wright, Ed.D.
New York University, 1954

Chairman: Associate Professor Robert L. Thompson

The Problem

The purpose of this study was to develop a reference book of teaching aids for the industrial arts general woodworking shop on the high school level.

Need for the Study

As the philosophy of industrial arts has broadened, the course content reflected this expansion. The introduction of a variety of shop offerings interpreted more adequately the industrial world and its products. This enlargement of view makes increased demands on supervisor, teacher, and pupil.

The industrial arts teacher faces a pupil group varied in intellectual capacity. To present this expanded subject area adequately, a wide use of all aids to adequate pupil comprehension is indicated.

Examination of the literature revealed a variety of teaching aids. However, they were not organized in forms which made them easily available to the teacher or comprehensible to the student. Thus, it was difficult for the teacher to comply with state recommendations for the planned inclusion of these supplementary instructional materials.

Procedure Used to Collect Data

A survey was made to determine what instructional aids were needed for the teaching of industrial arts woodworking in the New York City high schools. Eighty-seven woodworking teachers received this questionnaire. Fifty-four per cent were returned. The results indicated that a majority of teachers wished to see an amplification of teaching aids in thirty-two areas of the New York State Course of Study in Industrial Arts.

Guided by this, the candidate explored many avenues for satisfactory teaching aids. Some of these

were appropriate museums, industrial establishments, the United States Department of Defense, and originations by the candidate. One hundred and eighty-six teaching aids were collected, adapted, or constructed to fit the course requirements.

An evaluative study was made to determine whether these teaching aids met the needs of the high school industrial arts teacher in New York City. The teaching aids, developed by the investigator, were rated by a panel of thirty industrial arts teachers. These developed teaching aids, eighty-four in number, were arranged in ten related groups. Three teachers from the rating panel examined a group of teaching aids, completing an evaluation form for each aid. Two hundred and forty-six rating scales were returned by the thirty cooperating raters. The returns revealed that sixty-nine teaching aids were rated from good to excellent. This constituted 84.2 per cent of the entire group, a strong measure of agreement.

The entire group of one hundred eighty-six teaching aids was described in sufficient detail to supply the industrial arts teacher with an understanding of their use, construction, utilization, and coordination with the course of study. This constituted the resource unit of teaching aids.

Conclusions and Recommendations

This document indicates a method for the development of teaching aids for industrial arts. The evidence, derived from the collective evaluations of the assembled teaching aids, appears to indicate that such a resource unit of teaching aids may contribute to the expressed needs of the New York City high school industrial arts teacher.

Several additional investigations are suggested. Using this developmental pattern, it should be possible to isolate suitable teaching aids for other subject areas in industrial arts. Likewise, a combined teaching aid manual should be useful for teachers of general shop.

The teaching aids in this document have not been statistically evaluated. Also, no comparisons were made concerning the effectiveness of different instructional mediums. These areas may need investigation.

452 pages. \$5.65. MicA 55-131

ENGINEERING

ENGINEERING, AERONAUTICAL

CALCULATION OF LAMINAR BOUNDARY LAYER FLOW ON ROTATING BLADES

(Publication No. 10,583)

Martha E. Graham, Ph.D.
Cornell University, 1954

Momentum methods are applied to the calculation of the laminar boundary layer on a rotating blade (such as a propeller or helicopter blade). A simple and routine procedure is developed for finding the boundary-layer flow on an infinite cylindrical blade of arbitrary cross-section. Solutions computed by this method compare satisfactorily with the few known solutions for cylinders of special cross-section. The boundary-layer flow is computed for two new examples: (1) a cylindrical blade with a circular-cross-section, rotating about an axis through and normal to its centerline, and (2) a cylindrical blade with a symmetrical laminar-airfoil cross-section, rotating about an axis normal to its chord. Graphs are presented which show typical surface streamlines and spanwise velocity profiles.

Several essential features in the development of the method are the following. In a region far from the axis of rotation, the chordwise flow can be considered independently of the spanwise flow, and can be obtained directly from the two-dimensional flow about the blade. The equation describing the spanwise flow is then linear, with coefficients depending upon the chordwise flow solution. The spanwise velocity can then be separated into several parts, corresponding to the various inhomogeneous terms (Coriolis force, spanwise pressure gradient and centrifugal-force terms) appearing in the equation. After a further subdivision of one of these parts (explained in detail in the thesis) the momentum method is applied. This consists in choosing for each part of the spanwise flow a suitable one-parameter family of velocity profiles containing an unknown scale factor and an unknown shape parameter. These unknowns are determined by satisfying the momentum equation and the boundary-layer equation evaluated at the blade surface. The solution of the momentum equation (a first order non-linear differential equation) must be done numerically, but is readily carried out with the aid of charts provided for that purpose.

92 pages. \$1.15. MicA 55-132

ENGINEERING, CHEMICAL

CARBON MONOXIDE ATTACK OF REFRACTORIES

(Publication No. 10,109)

William Alfred Frad, Ph.D.
University of Missouri, 1954

Supervisor: Paul G. Herold

This investigation deals with the attack of carbon monoxide on two kaolins, simulated commercial refractory mixes and some commercial firebrick. The effect of various chlorides, sulfates, and phosphates, on the resistance of fired ceramic material to carbon monoxide at 500-550°C., was also studied. Analysis of the exit gas from the testing furnace was made to determine whether the small amounts of hydrogen and methane in the purchased carbon monoxide gas entered into the reactions causing destructive carbon deposition. The changes in the ferric oxide added to give iron bearing nuclei for carbon deposition were studied by means of X-ray diffraction. The presence of graphite led to a quantitative estimation of the amount present by means of the Norelco Geiger Counter X-Ray Spectrometer.

Testing was done in a horizontal furnace, electrically heated and controlled. The reaction chamber was made of non-catalytic Inconel. Flow rate, maintained at about 0.2 cubic feet of CO per hour was measured by a wet test gas meter. Five hundred hours of testing at 550°C., were completed. Tests at 500°C., and 525°C. were less extensive.

The two kaolins were a primary North Carolina kaolin, and a sedimentary Florida kaolin. Chemical analysis showed the iron oxide content practically identical at 1.4 and 1.6 per cent of Fe_2O_3 by weight respectively. No kaolin specimen without added iron oxide failed in the tests. The particle size range of the kaolins was determined by the standard Andreasen pipet method. The larger amount of fine material (under 0.5 micron) in the Florida kaolin was believed to be connected with the earlier failure of pieces fired from it, as catalytic activity is dependent upon surface area.

Iron oxide, chemically pure and spectrographically tested was uniformly mixed with the starting materials as a 5 per cent, or concentrated in location as a 2 per cent by weight addition. Laboratory specimens were fired at temperatures from 1,100 to 1,260°C.

The following factors were found to cause earlier destruction by carbon monoxide: lower burning temperature, concentration of iron bearing material, absence of any treating agent, and greater surface area. Sulfates were found to be better than chlorides or phosphates when used as a treating bath for the fired ware prior to testing. Ammonium sulfate was found

to be very powerful in preventing carbon monoxide attack. Use of this substance also caused corrosion of the Inconel furnace cover and cessation of subsequent carbon deposition.

Gas analysis showed that for the testing temperature range employed, the small amounts of methane (under 1 volume per cent) present in the purchased carbon monoxide did not react. The comparable amount of hydrogen present was also of minor effect.

The X-ray diffraction patterns using filtered iron radiation showed that for the firing temperatures used, destruction of the fired ware by carbon deposition occurred upon partial or complete reduction of the added ferric oxide to magnetite. Small amounts of cementite and metallic iron may have been present. Quantitative estimation of graphite was made with the Norelco Spectrometer, using a special technique to avoid excess preferred orientation of graphite in the powder compacts. A working curve was prepared for known mixtures of graphite and magnetite, using fluorite as an internal standard. Since automatic recording was used the accuracy was only fair. Graphite in eleven typical samples was present in amounts from 0.1 to 10 per cent by weight. Refractory destruction caused by crystallization of deposited carbon as graphite is evidently of minor effect. Magnetite was found to be present in amounts ranging from less than 20 per cent to practically 100 per cent by weight.

338 pages. \$4.23. MicA 55-133

DEPOSITION OF AEROSOL PARTICLES FROM TURBULENT GASES

(Publication No. 10,476)

Sheldon Kay Friedlander, Ph.D.
University of Illinois, 1954

The purpose of this study was to investigate experimentally and theoretically the deposition of suspended particles from turbulent gases. The rate of deposition depends on two factors, the rate of transport of the particles from the gas to the wall, and the behavior of the particles after they reach the wall, i.e., adhesion to the wall or other particles, reentrainment, or bouncing. The second effect was investigated only incidentally to the first; precautions were taken to ensure the adhesion of all particles which struck the wall, and to prevent more than a single layer of particles from accumulating.

The aerosols used were composed of iron particles, aluminum particles, and Lycopodium spores with densities of 7.80, 2.70, and 1.75 g./cc., respectively. The mean particle diameters were 0.8, 1.57, 1.81, 2.63, and approximately 30 microns. The turbulent field was established by passing the aerosols through 0.54, 1.3, and 2.5 cm. tubes at Reynolds numbers ranging from 2,100 to 35,000. The deposition was measured in the region of fully developed turbulence by counting the number of individual particles on the tube wall with a microscope. In most cases, the concentration was measured by passing a known volume

of gas through a Millipore filter and counting the particles on the surface of the filter.

The results are reported in terms of a "particle transfer coefficient" defined as $k = N_0 / c_{av}$, where N_0 is the number of particles striking the wall per unit time per unit area and c_{av} is the average concentration of particles.

The following model is hypothesized for the transport of suspended particles from a turbulent gas to a surface: Eddies carrying particles diffuse from the turbulent core to within a stopping distance of the wall; from this point the particles deposit as a result of their inertia. The stopping distance, or distance which a particle will move through a stagnant gas with a given initial velocity, is based on the root mean square of the radial component of the fluctuating gas velocity. For most of the tests, it was found that the stopping distance was less than the thickness of the laminar sublayer. Consequently, it was necessary to assume the presence of fluctuations in the sublayer. For this, the equation of Lin, Moulton, and Putnam (1) for the sublayer eddy diffusivity was employed. Based on these assumptions, calculations were made of the transfer coefficient in the manner of von Karman (2). The theory was found to agree fairly well with the data. For particles thrown from the sublayer, the transfer coefficient increased with about the fourth power of particle diameter and the 4.5 power of the average gas velocity.

84 pages. \$1.05. MicA 55-105

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AN INVESTIGATION OF THE CHARACTERISTICS OF HIGH ALUMINA REFRACTORY CASTABLES

(Publication No. 10,123)

Gajendra Nath Mohanty, Ph.D.
University of Missouri, 1954

Supervisor: Paul G. Herold

This investigation was started to study the high temperature expansion characteristics of Refractory Castables which are predetermined blended mixture of graded refractory aggregates and high fusing hydraulic cements. The problem was extended to include the following:

1. The design of a thermal expansion apparatus for determinations to temperatures of 1600°C.
2. X-ray study of compounds in the $\text{CaO}-\alpha\text{Al}_2\text{O}_3$ and $\text{BaO}-\alpha\text{Al}_2\text{O}_3$ systems.
3. Expansion behavior of the compounds $3\text{CaO} \cdot 16\text{Al}_2\text{O}_3$, $3\text{SrO} \cdot 16\text{Al}_2\text{O}_3$, and $\text{BaO} \cdot 6\text{Al}_2\text{O}_3$.

4. The synthesis of the pure hydraulic cements, $\text{CaO} \cdot \text{Al}_2\text{O}_3$, $\text{CaO} \cdot 2\text{Al}_2\text{O}_3$, and $\text{BaO} \cdot \text{Al}_2\text{O}_3$; study of the crystal components of Lumnite; study of the high and low temperature expansion behavior of Lumnite, synthetic $\text{CaO} \cdot \text{Al}_2\text{O}_3$, $\text{CaO} \cdot 2\text{Al}_2\text{O}_3$, and $\text{BaO} \cdot \text{Al}_2\text{O}_3$; and other auxiliary properties.
5. The preparation of refractory castables using Lumnite, $\text{CaO} \cdot \text{Al}_2\text{O}_3$, $\text{CaO} \cdot 2\text{Al}_2\text{O}_3$, and $\text{BaO} \cdot \text{Al}_2\text{O}_3$; their high temperature expansion characteristics and other auxiliary properties; X-ray study of the castables and explanation of the data based on the $\text{CaO} \cdot \text{Al}_2\text{O}_3$ - SiO_2 and $\text{BaO} \cdot \text{Al}_2\text{O}_3$ - SiO_2 systems.

A novel technique using the dilatometer principle is developed to measure expansion at high temperatures and was successfully carried out to 1600°C . The results indicate that:

1. Only five definite compounds, namely, $3\text{CaO} \cdot \text{Al}_2\text{O}_3$, $12\text{CaO} \cdot 7\text{Al}_2\text{O}_3$, $\text{CaO} \cdot \text{Al}_2\text{O}_3$, $\text{CaO} \cdot 2\text{Al}_2\text{O}_3$ and $3\text{CaO} \cdot 16\text{Al}_2\text{O}_3$ occur in the $\text{CaO} \cdot \alpha\text{Al}_2\text{O}_3$ system. The speculated compound, $5\text{CaO} \cdot 3\text{Al}_2\text{O}_3$ is a mixture of $12\text{CaO} \cdot 7\text{Al}_2\text{O}_3$ and $\text{CaO} \cdot \text{Al}_2\text{O}_3$; $3\text{CaO} \cdot 5\text{Al}_2\text{O}_3$ is a mixture of $\text{CaO} \cdot \text{Al}_2\text{O}_3$ and $\text{CaO} \cdot 2\text{Al}_2\text{O}_3$; $\text{CaO} \cdot 6\text{Al}_2\text{O}_3$ is a mixture of $3\text{CaO} \cdot 16\text{Al}_2\text{O}_3$ and $\alpha\text{Al}_2\text{O}_3$.
2. d-spacings and line intensities are reported for $12\text{CaO} \cdot 7\text{Al}_2\text{O}_3$, $\text{CaO} \cdot 2\text{Al}_2\text{O}_3$ and $3\text{CaO} \cdot 16\text{Al}_2\text{O}_3$. The diffraction pattern of $\text{CaO} \cdot 2\text{Al}_2\text{O}_3$ gives a fairly strong line ($d=1.376 \text{ A.U.}$), heretofore unreported.
3. Only three definite compounds are confirmed in the $\text{BaO} \cdot \alpha\text{Al}_2\text{O}_3$ system; they are $3\text{BaO} \cdot \text{Al}_2\text{O}_3$, $\text{BaO} \cdot \text{Al}_2\text{O}_3$ and $\text{BaO} \cdot 6\text{Al}_2\text{O}_3$; d-spacings for the compounds are reported. The $3\text{BaO} \cdot \text{Al}_2\text{O}_3$ spacing is reported for the first time.
4. It is discovered that $3\text{CaO} \cdot 16\text{Al}_2\text{O}_3$, $3\text{SrO} \cdot 16\text{Al}_2\text{O}_3$ and $\text{BaO} \cdot 6\text{Al}_2\text{O}_3$ exist in two forms; α , the low temperature form and β , the high temperature form; the transition point for $3\text{CaO} \cdot 16\text{Al}_2\text{O}_3$ is between 1375° - 1560°C . and for $3\text{SrO} \cdot 16\text{Al}_2\text{O}_3$ and $\text{BaO} \cdot 6\text{Al}_2\text{O}_3$ it is higher.
5. Lumnite cement consists of $2\text{CaO} \cdot \text{Al}_2\text{O}_3 \cdot \text{SiO}_2$, $\text{CaO} \cdot \text{Al}_2\text{O}_3$, $4\text{CaO} \cdot \text{Al}_2\text{O}_3 \cdot \text{Fe}_2\text{O}_3$, $\text{CaO} \cdot 2\text{SiO}_2$ and glass; $2\text{CaO} \cdot \text{Al}_2\text{O}_3 \cdot \text{SiO}_2$ is more predominant than $\text{CaO} \cdot \text{Al}_2\text{O}_3$ which shows the generally accepted view that Lumnite cement is primarily calcium monoaluminate cement is incorrect.
6. The low temperature expansion of hydraulic-set Lumnite, $\text{CaO} \cdot \text{Al}_2\text{O}_3$ and $\text{CaO} \cdot 2\text{Al}_2\text{O}_3$ reveals that cracks produce in Lumnite may be due to the presence of $\text{CaO} \cdot 2\text{SiO}_2$, though small in amount. Refractory castables should be heated at a rate less than 1°C . per minute between 200° - 800°C . during firing. Expansion run on hydraulic-set $\text{BaO} \cdot \text{Al}_2\text{O}_3$ shows that it is not as suitable a hydraulic cement as the other cements.

7. Lumnite shows the highest expansion while $\text{CaO} \cdot 2\text{Al}_2\text{O}_3$ is the lowest, and $\text{CaO} \cdot \text{Al}_2\text{O}_3$ and $\text{BaO} \cdot \text{Al}_2\text{O}_3$ are intermediate.
8. The pyrometric cone equivalent of Lumnite castables decreases very rapidly with increase in amount of cement from 10% to 20%. This is not the case with the other castables.
9. Using high duty fireclay grog, the approximate temperatures to which castables can be used satisfactorily are as follows: Lumnite castables to 1300°C ., $\text{CaO} \cdot \text{Al}_2\text{O}_3$ castables to 1375°C ., $\text{CaO} \cdot 2\text{Al}_2\text{O}_3$ castables to 1430°C ., and 10% and 20% $\text{BaO} \cdot \text{Al}_2\text{O}_3$ to 1360°C .
10. Lumnite castables and 10% and 20% $\text{BaO} \cdot \text{Al}_2\text{O}_3$ castables show the highest expansion compared to the others, and 30% $\text{BaO} \cdot \text{Al}_2\text{O}_3$ castables, the least. With increasing proportions of Lumnite, the expansion is lower whereas the reverse is true for other castables except for the 30% $\text{BaO} \cdot \text{Al}_2\text{O}_3$ castable.

244 pages. \$3.05. MicA 55-135

SPECTRUM OF TURBULENCE IN AXISYMMETRIC FLOW

(Publication No. 10,537)

John Emilio Romano, Ph.D.
University of Illinois, 1954

The theory of local isotropy of Kolmogoroff (2) has received much attention in the past decade because it postulates the existence of a region within the degrees of freedom of any turbulent field which is independent of the boundaries confining the field and, consequently, must be governed by universal laws. The laws giving the distribution of energy within this region of statistical equilibrium have been derived by several investigators (1, 2, 3). In this investigation the energy distribution in a turbulent field produced by air flowing isothermally in a duct was studied as a function of the position in the duct, the diameter of the duct, and the velocity through the duct.

The longitudinal one-dimensional spectrum function was measured over a wave-number range of approximately 10 ft.^{-1} to 1000 ft.^{-1} at different points at the end of each of three pipes, 1 1/8-inch diameter, 2-inch diameter, and 3 5/16-inch diameter. The measurements were made over a range of Reynolds numbers from 42,000 to 214,000, with a hot-wire anemometer and a wave analyzer.

The results indicate the region in wave-number space where local isotropy exists and, within this region, where dissipation of turbulent energy by viscosity is important. At high Reynolds numbers a non-viscous locally isotropic region is present in the spectrum of turbulence in wave-number space at the center of a pipe. The behavior of the wave number

at which the transition between anisotropy and isotropy occurs with changes in Reynolds number and pipe size is in complete agreement with the results predicted from the model of the dynamics of turbulence proposed by Kolmogoroff. The transition wave number is independent of the Reynolds number but varies inversely with the pipe diameter.

A simplified form of the equation of Heisenberg does not correctly represent the results for the transition between the non-viscous region and the viscous region in locally isotropic turbulence. This simple equation for the longitudinal one-dimensional spectrum function was obtained by combining the equation for the two extremes, non-viscous region and completely viscous region, to form an equation similar in form to the Heisenberg equation for the energy distribution function.

Kovaszny's equation (3) for the longitudinal one-dimensional spectrum function does correlate the results in the region of local isotropy at the pipe center for wave numbers smaller than the empirical constant k_{10} . The constant R_0' is approximately two, and is independent of pipe size or Reynolds number. The empirical constant k_{10} is a unique function of the mean dissipation of energy per unit time for the case of constant kinematic viscosity as required by the theory. This theory breaks down, however, for wave numbers close to k_{10} or larger.

The mean dissipation of energy per unit time at the pipe center varies as the cube of the mean velocity as would be predicted from dimensional arguments for the case of fully developed turbulent flow independent of the conditions at the pipe wall.

The effect of the pipe wall on the dynamics of turbulence increases with increase in distance from the axis to the wall. The wave number at which the transition between anisotropy and isotropy occurs increases with distance from the axis to the wall. This increase may be attributed to the increase in the shear force and the velocity gradient. In this case, the turbulent production mechanism gives rise to a spectrum of perturbations covering a wide range, i.e., the pattern of the perturbations arising directly from the production mechanism is rich with small as well as large perturbations. Also, with increase in distance from the axis to the wall, the mean dissipation of energy per unit time varies as the velocity to a power less than three, thus indicating the effect of the conditions at the wall.

115 pages. \$1.44. MicA 55-136

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REACTION KINETICS IN FLUIDIZED BEDS

(Publication No. 10,545)-

Chung Yu Shen, Ph.D.
University of Illinois, 1954

Although fluidization processes have been used in industry for several years, little is known of the mechanism of gas-solid catalytic fluidized reactions. From the concept of two-phase fluidization proposed by Toomey and Johnstone (2), a model of the reacting system may be assumed from which the intimacy of contact may be estimated. In the continuous phase, the catalyst is supported by the gas stream at the same velocity as that at incipient fluidization. In the discontinuous phase, the excess gas moves through the bed in the form of bubbles and channels.

The catalytic oxidation of ammonia in the temperature range from 200 to 250°C, and the catalytic decomposition of nitrous oxide in the range from 370 to 430° were studied to verify the assumed model and mechanism. The fluidized reactor was 4-1/2 inch i.d. and 43 inches high, and was made of Type 310 stainless steel. The catalyst was an alumina cracking catalyst impregnated with manganous oxide and bismuth oxide. A part of the data on the oxidation of ammonia were recalculated from a previous study (1).

The effect of temperature on the reaction rate in the fluidized reactor for both reactions follows the Arrhenius equation and the heat of activation is the same as for the fixed bed. However, the reaction rate changes with the rate of gas flow. For the oxidation of ammonia, the rate in the fluidized bed increases with gas velocity. This is apparently due to the increase in the rate of diffusion of the products from the surface and the increase of the effectiveness of the turbulent movement of catalyst particles. The rate in the fluidized bed may be estimated from the fixed bed rate by an empirical equation in terms of a power function of gas velocity.

In the presence of the discontinuous phase, the reactants, for the most part, must be transferred into the continuous phase to react. The increment of the reaction rate above that at incipient two-phase fluidization may be attributed to the increment of the transfer rate between the two phases. The relation of the increment of the reaction rate to the gas velocity should be analogous to the pressure drop relationship (2), so that the rates should be correlated by an equation of the type, $R_d/R_c = K \ln(V/V_c)$, where R_d is the reaction rate in the discontinuous phase, R_c is the rate in the continuous phase, and V is the volumetric gas velocity. The constant K is an inverse function of the catalyst size, as shown by the experimental results and by derivation from the pressure drop relationship.

The transfer rate between the two phases may be expressed in terms of a transfer coefficient evaluated from the experimental data. In order to set up the simultaneous rate equations, the continuous phase is assumed to be either uniformly mixed, or completely unmixed, and the discontinuous phase passes without mixing. The effects of such factors

as velocity and density of the gas, particle size, and height of the bed, on the transfer coefficient were found for the experimental conditions studied. The coefficient may be applied to higher order reactions and to heat transfer. A comparison with heat transfer measurements was made (3). The application of the transfer coefficient to reactor design is discussed.

117 pages. \$1.46. MicA 55-137

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THE EFFECT OF MOLECULAR PROPERTIES ON INTERFACIAL RESISTANCE

(Publication No. 10,548)

John Henry Sinfelt, Ph.D.
University of Illinois, 1954

Mass transfer operations in chemical engineering usually involve the transport of molecules between phases. It has been assumed that the interface between the phases offers no resistance to mass transfer. However, this assumption has been made largely for convenience in calculation and design.

The use of radioactive tracers offers a convenient method of checking experimentally the assumption of no resistance at an interface. The experiments of Lu-Ho Tung at the University of Illinois in 1951 showed that resistance to diffusion across a liquid-liquid interface could be appreciable. The purpose of the present work was to consider the effect of molecular properties on interfacial resistance. The diffusion of S^{35} across an interface was studied for six systems: aniline-methylcyclohexane, normal heptane-nitrobenzene, normal heptane-nitromethane, normal heptane-aniline, normal heptane-phenol, and normal heptane-formic acid. All the experiments were done in saturated solutions, e.g., the diffusion of S^{35} from a layer of normal heptane saturated with aniline across an interface into a layer of aniline saturated with normal heptane. The variation of diffusion coefficients with concentration was thus eliminated. The systems investigated were chosen because of the wide variation in dipole moment and extent of hydrogen bonding.

The interfacial resistance was low for the nitrobenzene-normal heptane and the nitromethane-normal heptane systems, in which the nitrobenzene and nitromethane both have high dipole moments. The interfacial resistance was higher for the aniline-normal heptane system, still higher for the phenol-normal heptane system, and highest for the formic

acid-normal heptane system. The latter three systems had considerably smaller dipole moments than the first two, but they were capable of forming hydrogen bonds. The interfacial resistance of the latter three systems increased as the extent of hydrogen bonding increased. Thus the extent of hydrogen bonding gives a consistent correlation with interfacial resistance, whereas the dipole moment does not. The orientation effect of the dipole moment is thus not sufficient at an interface to cause a high interfacial resistance. The orientation effect is much stronger in systems which exhibit considerable hydrogen bonding.

Interfacial tension does not give a consistent correlation with interfacial resistance. Addition of an interfacial active agent, while lowering the interfacial tension, did not affect the interfacial diffusion rate for a system with high interfacial resistance or for a system with low interfacial resistance. In mass transfer equipment it has been observed that wetting agents reduce transfer. However, in these cases the effect of the wetting agent is probably not to block the passage of the diffusing molecules at the interface, but to eliminate rippling or some similar hydrodynamic disturbance at the phase boundary.

Calculated values of the free energy of activation for interfacial diffusion are several times as large as values for single phase diffusion. The values are of the order of magnitude of activation free energies for adsorption. Interfacial diffusion may thus be pictured as an adsorption process, in which the molecules diffusing to the interface must possess sufficient energy to be adsorbed on the surface of the other phase. For systems with low interfacial resistance the adsorption is of the van der Waals' type, i.e., physical in nature, whereas for systems with high interfacial resistance the process approaches chemisorption.

74 pages. \$1.00. MicA 55-138

ENGINEERING, CIVIL

THE EFFECT OF EDGE CONDITIONS ON THE TENDENCY TOWARD BRITTLE FRACTURE OF STRUCTURAL STEELS

(Publication No. 10,487)

Leonard Andrew Harris, Ph.D.
University of Illinois, 1954

The purpose of this investigation was to determine the effect of edge conditions on the ductile behavior and on the tendency toward brittle behavior of structural steels. Specimens from four steels, designated by ASTM specifications A7 (semi-killed), A7 (rimmed), A94 (silicon), and A242 (low alloy high tensile), were fabricated with the test edges prepared either by shearing, machining, manual flame-cutting, or automatic flame-cutting. Additional

studies have been made of the effect of a welding arc-strike on a machined or on a sheared edge and of the effect of manually flame softening a sheared edge or a flame-cut edge (A94 silicon steel only).

The results of the tests indicate that the structural machining edge preparation will not adversely affect the strength or the ductility of a structural steel.

The guided automatic flame-cutting procedure also is likely to be a satisfactory edge preparation provided the material being cut does not have too high a hardenability. Generally, steels which correspond to the ASTM specifications A7 and A242 will be acceptable without further treatment, whereas steels corresponding to the ASTM specification A94 will not be acceptable without further treatment. The flame-cut edge should be as smooth as possible and flame-cut notches must be avoided to prevent low ductility. For the A94 structural silicon steel, the detrimental effect of the flame-cut edges can be eliminated if the edge is subsequently flame softened.

In contrast to the automatic flame-cutting procedure, edges prepared by manual flame-cutting are likely to fracture with low ductility, especially at low temperatures.

The most dangerous edge condition encountered in these tests was the sheared edge, in which condition specimens from all four of the steels fractured with low ductility and low energy absorption, and some specimens fractured at low maximum stresses (approximately of yield point magnitude). In this latter case, the factor of safety in design not only becomes dangerously low, but also becomes a factor of safety against a sudden, complete fracture.

The tests have shown that the brittle behavior of the steels with sheared edges can be eliminated by a subsequent flame softening treatment. It is possible that the flame softening of a punched hole would improve similarly the behavior of the punched hole to the extent that the punched hole would be satisfactory for structural applications.

A limited investigation of the effect of an arc strike on a machined edge showed that the arc strike was a potential source of a brittle fracture; therefore, effort should be made to avoid the occurrence of an arc strike in a welded structure.

133 pages. \$1.66. MicA 55-139

A SUGGESTED REVISION OF THE LAWS OF KANSAS REGULATING LAND SURVEYING AND LAND REGISTRATION

(Publication No. 10,596)

John Gerald McEntyre, Ph.D.
Cornell University, 1954

The purpose of this study is to develop a simple, accurate, and economic system for the surveying of land and the filing of records, to assure that the work is performed by qualified personnel, and to fix the responsibility for recorded facts.

As a starting point in this study letters of inquiry

were sent to all forty-eight states, addressed to their respective secretaries of state, for information concerning their land laws and their regulations concerning land surveyors. The boards of registration for professional engineers and land surveyors or its equivalent was contacted in each of the states. In addition letters of inquiry were sent to various individuals and agencies throughout the United States such as land surveyors, title insurance companies, and the United States Coast and Geodetic Survey, who would be interested and experienced in the subjects of land surveying and land registration.

This study is divided into five main areas. By correcting deficiencies in these areas land surveying and description will become reliable functions within the state of Kansas. The areas studied are:

- (1) Licensing land surveyors.
- (2) Establishing a state plane coordinate system.
- (3) Surveying, describing, and recording real property, general case.
- (4) Surveying, describing, and recording real property, new subdivisions.
- (5) Establishing an appropriate state administrative system.

Any state could approach the study by use of these five subdivisions. Each state would have a few individual problems in each area. In general a proposed code in each state could follow the pattern suggested in this thesis.

To establish a basis for the accurate description of land two laws are proposed for Kansas. First, a registration law for land surveyors is proposed. This insures that only qualified men will perform land surveys. Second, a state plane coordinate system is proposed. This makes an accurate control system available for use by registered land surveyors. Also it furnishes an accurate and simple method to describe land.

A thirty-year land program for Kansas is proposed. This land program is divided into three periods each ten years in duration. In the Initial Period the state is to determine accurately the coordinates of all township and section corners within the state and the legislature is to enact a rerecording statute or "curative act". In the Intermediate Period the coordinates of all individual property and the exterior corners of all recorded subdivisions are to be determined. In the Intermediate Period each individual plot of land will be given a number called a "parcel number". In the Final Period all land will be registered by the state. Once land is registered by the state no title searches are necessary when it is transferred. The certificates of title issued by the state will describe the land by its parcel number and by its coordinates and will list all interests, legal or equitable, in the land.

In the final portion of this thesis a state administrative system is proposed with definite qualifications for its personnel. This office is to direct the land program of Kansas toward its desired goal of accurate land description and secure titles to land.

206 pages. \$2.58. MicA 55-140

ENGINEERING, ELECTRICAL

EXCITATION PROCESSES IN LC DISCHARGES
IN NEON-ARGON MIXTURES

(Publication No. 10,458)

Clarence Leroy Coates, Jr., Ph.D.
University of Illinois, 1954

The spectrum which is emitted by the plasma of a DC discharge of neon is excited directly by electron excitation of atoms from the ground state and cumulatively by further electron excitation of the neon metastable states. For pressures of 1 and 2 mm of Hg and for electron densities of from 10^9 to 10^{11} electrons per milliliter practically all of the excitation of the states from which visible radiation results is by the direct process. For pressures of 4 and 8 mm of Hg and for electron densities of from $5 \cdot 10^9$ to $5 \cdot 10^{11}$ electrons per milliliter both processes of excitation are important. From about 25 to 40% of the excitation of the $3p^3P_0$ state results from further excitation and the rest is direct excitation from the ground state.

When argon is added to a neon discharge, so that the partial pressure of argon is less than 5% of the total pressure, the spectrum of the argon is excited and the spectrum of the neon is quenched. The extent to which each of these effects takes place depends upon the total pressure of the gas mixture in which the discharge occurs. For example, at an electron density of 10^{10} electrons per milliliter and at a pressure of 1 mm of Hg the introduction of .1% of argon reduces the intensity of the 5852 Å line of neon to about 68% of its former value while at a pressure of 8 mm of Hg the same percentage of argon reduces it to about 5%. By the addition of the argon atoms neon metastable-argon collisions are made possible and these collisions result in the ionization of the argon. Since electrons and argon ions are produced by this process, the electron production and diffusion rates are altered. The result of this is that the mean energy of the electrons in the plasma is reduced. This energy reduction accounts for the quenching of the neon spectrum.

The excitation of argon to states from which visible radiation results is caused by collisions between electrons and normal argon atoms. It is remarkable that the intensity of the visible light of argon which is emitted by discharges of certain neon-argon mixtures is greater than that from a pure argon discharge under the same conditions of pressure and electron density. This is attributed to the mean energy of the electrons which is enough larger for the neon-argon discharges than for discharges of pure argon to more than offset the smaller argon atom density of the former.

124 pages. \$1.55. MicA 55-141

FARADAY ROTATION OF ELECTROMAGNETIC
WAVES IN WAVEGUIDES CONTAINING GASEOUS
DISCHARGE PLASMAS WITH APPLIED
LONGITUDINAL MAGNETIC FIELDS

(Publication No. 10,469)

James Edgar Etter, Ph.D.
University of Illinois, 1954

The propagation of TE_{11} -type waves in circular cross-section waveguide filled with the gyromagnetic electron gas of a rare gas discharge plasma has been investigated. Propagation of a 10 μ sec duration rf pulse of a frequency of 5000 Mc was used at variable times in the decays of isothermal discharge plasmas at 300° K. The plasmas were produced in neon gas at 1 to 200 mmHg pressures and helium at 5 to 20 mmHg pressures. Magnetic field strengths up to 3500 gauss maximum were applied to the plasmas in a direction parallel to the waveguide axis.

Desired polarizations, either circular or linear, of the waves within the plasma-filled waveguide were excited by TE_{11} waves of similar polarizations propagated in the guide incident to the plasma-filled section. Measurements of the velocity of propagation within the plasmas and the losses incurred in transmission were obtained by comparing the incident and transmitted waves by means of a waveguide bridge. When incident waves of linear polarization were used, changes in polarization and intensity of the transmitted wave were measured.

Two oppositely rotating, circularly polarized modes of propagation were found. Both exhibit resonances at magnetic field strengths at which the gyro frequency of the free electrons equals the rf signal frequency. The waveguide mode whose field pattern rotates with the electrons, at gyroresonance, exhibits by far the greater resonance, and is cut-off over a range of magnetic field below resonance. The behaviour of these modes was found to agree well with computations based on a recently published analysis.

When the oppositely rotating waves are excited with equal amplitude in the absence of a magnetic field, the result is a linearly polarized wave. At low magnetic field intensities, the linear wave undergoes Faraday rotation. Measured values of the associated Verdet constant were in close agreement with theoretically predicted values. The non-reciprocal nature of the rotation was demonstrated.

As the magnetic field was increased the rotation of the plane of polarization attained a maximum value corresponding to the cut-off of one of the two circularly polarized components. The other component continued to propagate with little or not attenuation, and consequently the polarization of the transmitted wave in this region was nearly circular. Past gyroresonance, the rotation was reversed in sense from that at magnetic fields below resonance. The magnitude of the rotation decreased with further increase in magnetic field and the polarization became more nearly linear.

It was also found that the superposition of the data for the oppositely circularly polarized waves

yielded the results of the linear wave experiments.

The effects of electron density and electron-gas atom collisions upon the propagation were investigated. 134 pages. \$1.68. MicA 55-142

EFFECT OF SURFACE CONDITIONS ON CHARACTERISTICS OF RECTIFIER JUNCTIONS

(Publication No. 10,491)

Nick Holonyak, Jr., Ph.D.
University of Illinois, 1954

Previous studies indicate that there are two different ways that the surface can affect the properties of germanium. Electrons and holes may recombine at the surface at rates which are determined by the surface treatment, i.e., the surface may affect the lifetime of minority carriers. Second, an alteration of the nature of the conduction near the surface may occur as a result of the formation of a space charge layer. In the latter case an inversion layer may be formed so that conduction near the surface is of opposite type to that of the bulk.

These effects, in particular their influence upon the characteristics of small area rectifying contacts, have been studied. Rather than depending on pressure point contacts of uncertain properties, methods have been developed for fusing to n-type germanium indium contacts with diameters of the order of .01 cm. The lifetime of injected holes in such units is studied by two methods. One is to measure transient reverse current following forward bias, or junction floating potential following application of a pulse in the forward direction. The second is to observe the current collected by a junction when an interrupted line source of light is focused at varying distances from the junction. The latter method is inapplicable when surface recombination is high, and when inversion layers exist on the surface, gives "channel" information ("channel" length) rather than lifetime. The influence of inversion layers upon surface conduction is examined by studying the current-voltage characteristics.

It is found that gaseous ambient changes have little if any effect upon lifetimes as determined by recovery current and open circuit (floating) voltage measurements. This insensitivity of transient measurements to surface change is best accounted for in terms of the geometry (hemispherical geometry), one such that the ratio of exposed surface to volume at the contact is low. Exposure of the units (junctions) to an ionized hydrogen ambient produces a large irreversible increase in surface recombination, with consequent large decrease in lifetime and without at the same time giving very much increase in reverse current. (The back resistance of the junction is still four or five orders of magnitude higher than the forward resistance, but hole storage is greatly reduced due to increased surface recombination.) When an ozone ambient is employed, either

without or following exposure to ionized hydrogen, an inversion layer is formed and there is a large reversible increase in reverse saturation current. The large reversible increase in reverse saturation current occurring with ozone is explained by assuming an inversion layer which "pinches-off" with voltage. 101 pages. \$1.26. MicA 55-143

SYNTHESIS OF APERTURE ANTENNAS

(Publication No. 10,495)

Carl Theodore Adolf Johnk, Ph.D.
University of Illinois, 1954

Synthesis methods are considered for plane aperture antennas having rectangular and circular boundaries. The aperture fields are considered to be transverse, which reduces the expression for the far zone retarded fields to the familiar Kirchhoff-Huygens diffraction integral. The aperture-field symmetries considered for the two cases permit expressing the far zone field as an integral transform of the aperture distribution. These restrictions also permit finding a series expression for the unknown aperture distribution as an integral transform of a derived series expression for the given far zone pattern.

For the case of the rectangular aperture, field variation over the aperture is defined to be in one direction only. The method above is applied by deriving, from a Tchebyscheff polynomial formulation, an even polynomial having equal side lobe levels and a principal broadside lobe of preassignable amplitude. Using the Woodward-Taylor method of expressing a far zone pattern as a product of a transcendental function times a polynomial, a desired pattern having tapered side lobes of preassignable level is constructed from that even polynomial. The aperture distribution corresponding to that pattern is found from the Fourier transform of the pattern. This procedure permits finding broadside patterns having the narrowest beamwidth without supergaining, for a given aperture size and for the kind of side lobe tapering assigned. Aperture distributions for such designs have been calculated, and are observed to taper essentially to zero at the aperture edge. They consequently correspond to aperture conditions which are more nearly physically realizable than distributions having a substantial edge discontinuity. Comparison of these designs with other low side lobe designs provided by similar smooth-taper aperture functions, such as cosine functions raised to certain powers, shows that for comparable beamwidths a first side lobe level of the order of 10 db lower than that provided by the latter is given by these tapered side lobe designs. An inherent difficulty of establishing low side lobes from a practical standpoint is observed in the examples given, since a side lobe level 10 db farther down is shown to be accompanied by only minor aperture distribution changes.

For the case of the circular aperture, rotational

symmetry of the fields is assumed. A synthesis method is provided by deriving an orthogonal set of pattern functions from a well known, countable set of linearly independent pattern functions whose corresponding aperture distributions are known. The given field pattern to be synthesized is expressible as an infinite series of the orthonormal pattern functions, after finding the series coefficients by means of ordinary Fourier processes. The aperture distribution corresponding to the synthesized pattern is given by applying the same coefficients to the series of known aperture functions. The set of orthonormal pattern functions is an incomplete set, but this property assures that solutions to synthesis problems using this method are not supergain solutions. Thus, oscillatory approximations to given patterns are provided by this synthesis method. Examples of the results of using this method are given and include approximations to sector patterns, triangular patterns, Gaussian patterns, and secant patterns. The results show that an attempt to synthesize excessively narrow beams results in high field amplitudes at the aperture edge.

130 pages. \$1.63. MicA 55-144

LARGE SIGNAL THEORY ON THE PARALLEL PLANE TRIODE

(Publication No. 10,550)

Alan Duryea Sutherland, Ph.D.
University of Illinois, 1954

A theoretical investigation has been made to determine the effects of electron transit-times upon the performance of triodes as Class B or Class C amplifiers at ultra-high frequencies (UHF). The basis of this investigation is a large-signal analysis of the phenomena of space-charge flow in parallel plane triodes. In making the analysis, which takes into account the effects of space-charge upon potential in both the grid-cathode and the plate-grid regions of the triode, care has been taken to avoid restricting the validity of the equations derived to cases of single velocity flow only. This has been done not with the idea of searching out cases of multiple velocity flow for treatment, but rather to make the analysis more general, and capable of handling such cases if they should arise.

The parallel plane triode is treated as a single unit, rather than as two separate "diodes", as has been done by previous workers. A one-dimensional model, with an ideal, non-saturable cathode (i.e. space-charge limited), is devised to represent the parallel plane triode structure. The grid, in the model, becomes an "equivalent" plane of uniformly distributed surface-charge, the potential of which depends not only upon the applied voltages but also upon the instantaneous space-charge distribution within the electronic interaction regions. The representation of the grid in this manner takes into account the interaction effects between the grid-cathode

region and the plate-grid region caused by space-charge-induced fields. It is demonstrated that, for certain tube geometries, these interaction effects can be appreciable.

A set of dimensionless variables can be defined which is convenient for the description of a number of space charge flow problems. These variables are used in obtaining a set of differential equations which describe the model. The equations are then transformed to a set of integral equations which can be solved by an approximate step-by-step numerical method. The method of solution can be applied only to those cases for which all space-charge which is emitted during one cycle of the radio frequency (RF) is swept from the electronic interaction region during the same cycle. Class B and Class C operation are thereby included, provided that electron transit-times are not too long.

The numerical method of solution has been coded so that solutions may be obtained using Illiac, the University of Illinois Digital Computer. A number of solutions corresponding to the operation of triodes as Class B amplifiers under a wide range of operating conditions at UHF have been obtained by this means. The solutions so obtained show that, as electron transit-times increase, the induced current wave forms depart radically from the familiar three-halves-power current pulse which characterizes them at low frequencies. However, over the wide range of cases treated, neither the DC component nor the fundamental component of the induced plate current pulse changes materially in magnitude from the corresponding low frequency values. The principle effect is a shift in the phase of the fundamental component of the induced plate current, with respect to the input signal voltage. With the load across the output terminals tuned so as to appear as a pure resistance to the fundamental component of induced plate current, it is concluded, therefore, that triodes can be made to operate over a wide range of conditions at UHF with about the same RF power output and about the same efficiency as they do at low frequencies. This is a conclusion which has been reached earlier by P. T. Smith, on the basis of observations made with several experimental UHF triodes.

160 pages. \$2.00. MicA 55-145

ENGINEERING, MECHANICAL

A QUASI-STEADY METHOD OF MEASURING
THERMAL DIFFUSIVITY OF METALS
AT ELEVATED TEMPERATURES

(Publication No. 10,468)

Mohamed Alaeldin El-Hifni, Ph.D.
University of Illinois, 1954

The Angström bar method has been modified and adapted to the measurement of thermal diffusivity of metals in the temperature range from 250° F to 1050° F. A small, steady periodic temperature fluctuation is superimposed on the mean temperature of the specimen by means of simultaneous heating and cooling. The specimen is in the form of a tube mounted inside another tube of the same material which acts as a radiation shield. The whole apparatus is installed inside a forced-convection furnace equipped with automatic temperature control.

A mathematical analysis of the theory of the apparatus is presented which takes into account the small heat loss along the length of the specimen. It is shown that the thermal diffusivity can be calculated from the time lag for the sinusoidal wave to travel longitudinally from one measuring station of the specimen to a neighboring one. It can also be computed from the amplitude ratio of the temperature waves at these two stations. The effect of heat loss on the phase shift and the amplitude ratio has been investigated and a method developed for its computation.

Measurements were made on AISI 1018, 1045, 3140, 1.2 per cent C steel and AISI 430 stainless steel. Diffusivity values were also obtained for phosphorized copper, electrolytic tough pitch copper and 2S Aluminum. Results of the latter two showed good agreement with the theory of Hume-Rothery-Storm concerning the variation of thermal diffusivity of simple metals with temperature.

72 pages. \$1.00. MicA 55-146

GENERALIZED pvT PROPERTIES OF GASES

(Publication No. 9262)

Leonard Carl Nelson, Ph.D.
Northwestern University, 1954

The relationships between pressure, specific volume, and temperature are necessary prerequisites for evaluating the properties of a gas and to determine experimentally these relationships throughout the various states of all gases would be a laborious process. However, for engineering purposes, reasonable approximations to the pvT relationships are required especially for the case, more usual than unusual, where data are entirely non-existent. The object of this dissertation has been to provide a means of securing more data through applications of the various laws of corresponding states.

A set of four generalized compressibility charts were constructed on coordinates reduced by the critical constants:

$$P_r = \frac{P}{P_c} \quad T_r = \frac{T}{T_c} \quad v_{r'} = \frac{v}{RT_c/P_c}$$

Three of the charts present the compressibility factor (Z) as a function of reduced pressure (p_r) and reduced temperature (T_r). The pressure range covered by each chart maintains accuracy in reading consistent with the correlation of the data.

1. The low-pressure chart ($p_r = 0$ to 1, $T_r = 0.6$ to 15) constructed from the averaged data of 26 gases has a maximum deviation of the order of 1 per cent (except near the critical region).

2. The intermediate pressure-chart ($p_r = 0$ to 10, $T_r = 1$ to 15) constructed from the data of 26 gases has a maximum deviation of 2 1/2 per cent (except near the critical region).

3. The high-pressure ($p_r = 0$ to 40, $T_r = 1$ to 15) constructed from the data of 10 gases has a maximum deviation of 5 per cent.

The fourth chart presents a reduced Amagat compressibility factor ($p_r v_{r'}$) as a function of p_r and T_r and has essentially the same accuracy and range as Chart 2 (the intermediate-pressure chart). This chart has a unique presentation of an infinite number of reduced isochores ($v_{r'}$).

The rigor of the work of Hirschfelder, Bird and Spotz, and based upon the Lennard-Jones force potential, showed that a more fundamental method of analysis was available for the nonpolar gases with semi-symmetrical molecular structure. The theory shows that the reduced properties can be defined as follows:

$$p_{r'} = \frac{p b_0}{R \epsilon / k} \quad \tau = \frac{T}{\epsilon / k} \quad \rho_{r'} = \rho b_0$$

A set of two charts were constructed on these new coordinates from the averaged data of nine non-polar gases. The charts present the compressibility factor (Z) as a function of the pseudo-reduced pressure ($p_{r'}$) and the pseudo-reduced temperature (τ):

1. The low-pressure chart ($p_{r'} = 0$ to 0.3, $\tau = 1$ to 20). Maximum deviation is less than 1 per cent.

2. The intermediate-pressure chart ($p_{r'} = 0$ to 1.4, $\tau = 1.4$ to 20). Maximum deviation is less than 2 per cent.

Since an equation of state may, for certain calculations be desirable (where differentiation and integration are involved), six of the more widely used equations of state were investigated. A modified Bird and Spotz equation is proposed which enables their tabulations to be applied to gases with complex molecules:

$$Z = 1 + B^0(\tau) \left[\frac{17 p_c}{v T_c} \right] + C^0(\tau) \left[\frac{17 p_c}{v T_c} \right]^2$$

Where $B^0(\tau)$ and $C^0(\tau)$ are found in the Bird and Spotz tabulation, and p_c and T_c are critical constants.

The major points of this dissertation can be summarized as follows:

1. A complete bibliography of sources (showing pressure and temperature ranges) of the existing pvT data for gases, and a critical examination of the data.
2. The derivation and analysis of two new modifications of the van der Waals law of corresponding states.
3. A set of four charts are presented, based on a modified law of corresponding states, to enable the prediction of pvT properties in regions where the experimental data for a gas are non-existent.
4. A set of two charts are presented based on kinetic theory parameters which allows better correlation for gases with nonpolar molecules than that of the modified van der Waals law.
5. An examination of several generalized equations of state to establish their ability to reproduce the isotherms of the generalized chart.
6. The development of a relationship whereby the Bird and Spotz equation can be extended to include other than gases with nonpolar semi-symmetrical molecules.
7. A unique and improved method of obtaining the force constants of the Lennard-Jones force potential.

261 pages. \$3.26. MicA 55-147

ENGINEERING, METALLURGY

STUDY OF THE ORIGIN OF ANNEALING TEXTURES IN COPPER AND ALPHA BRASS

(Publication No. 10,518)

Alfonso Merlini, Ph.D.
University of Illinois, 1954

In order to test the validity of the oriented nucleation principle of Burgers, Liu and Tiedema, an experiment was carried out by determining quantitatively the deformation and annealing textures of cross-rolled copper. Even though the cross-rolled texture includes more material in the cube orientation than the straight-rolling texture does, the cross-rolled sheet does not develop the cube texture on annealing. This observation contradicts the oriented nucleation principle of Burgers, Liu and Tiedema. The eight main components of the annealing texture in cross-rolled copper may be derived from the two main components of the cross-rolling texture by 30° rotations around $\langle 111 \rangle$ axes, in accordance with the expectations of the oriented growth theory.

The effect of zinc additions on the rolling and annealing textures of copper was studied by determining quantitatively the deformation and annealing textures of straight-rolled 3, 6 and 10 weight per cent Zn brasses. The straight-rolling texture of alpha brasses may be described by means of four

main components, three orientation spreads and one minor component. The orientations of the four main rolling texture components change gradually with increasing Zn content and, in this respect, the transition from the copper to the 70-30 brass type of orientations is practically completed at 10 per cent Zn. Of the three orientation spreads, one is present in large amount for any Zn content; the amount of the "copper spread" decreases and that of the "brass spread" increases with increasing Zn content. In close analogy with the case of straight-rolled copper, the minor rolling texture component of alpha brass may be described by a $[100]$ fiber texture, with the axis in the rolling direction. The annealing texture of alpha brasses, from 3 to 10 per cent Zn content, consists of 15 components of five crystallographically different types. The oriented growth theory accounts for the decrease in the amount of the cube texture with increasing Zn content on the basis that: 1) the cube orientation becomes farther removed from a $\langle 111 \rangle$ rotational relationship with the four main rolling texture components, and 2) the center orientation of the "brass spread", whose amount increases sharply up to 3 per cent Zn, is very far removed from a $\langle 111 \rangle$ rotational relationship with the cube orientation. Each of four annealing texture components, in the three brasses investigated, maintains a $\langle 111 \rangle$ rotational relationship of 30° with a main rolling texture component; their orientations change gradually toward the orientations of the main annealing texture components of 70-30 brass and their amount increases with increasing Zn content. The oriented growth theory may account for the increase in the amount of these components on the basis that each of them becomes more favorably oriented for growth with regard to the other three main rolling texture components. The oriented growth theory does not offer any definitive conclusion as to the origin of two other types of annealing texture components; the uncertainties arising in the interpretation of the origin of these components might originate in the complexity of the rolling texture and in the approximations used for describing the rolling and annealing textures. The available principles of the oriented nucleation theory can not account for the origin of any annealing texture component.

139 pages. \$1.74. MicA 55-148

A STUDY OF THE DEFORMATION TEXTURE AND ITS VARIATION IN COLD DRAWN NICKEL RODS

(Publication No. 10,133)

Krishan Kumar Tangri, Ph.D.
University of Missouri, 1954

Supervisor: Daniel S. Eppelsheimer

This investigation deals with the determination of cold drawn textures in nickel rods, and the distribution of cold drawing effect on their cross-section.

A new x-ray diffraction technique for pole figure determination, which permits complete pole figure coverage with only one spherical specimen, was developed. The thickness of the metal layer during machining and polishing the specimen was determined by an x-ray diffraction method. Deformation textures in 20.6, 40.5 and 60 per cent cold drawn one inch diameter nickel rods were determined and corresponding figures were drawn. A new method for diagrammatic representation of texture data for drawn metals was proposed. A critical examination of the assumptions generally made for pole figure determination of cold drawn metals was made. The Calnan and Clews method of deformation texture analysis was examined and used to determine the probable origin of the tension, compression, and cold drawn textures in nickel.

An x-ray diffraction technique for quantitative determination of texture variation in metal rods was developed and variation of texture in the above mentioned nickel specimens was determined. Hardness measurements of the cross-section of the as drawn nickel rods were made and macrographs of the three specimens were prepared. Microstructure studies at various points on the cross-section of the as drawn and subsequently annealed specimens were made.

The [111] and [100] double fibre texture in cold drawn nickel rods was observed. The degree of alignment of [111] was much greater than that of [100], which showed considerable scatter from the ideal end orientation. Concentration of [111] orientation in 20.6 per cent cold drawn nickel increased two-fold with an additional 20 per cent cold reduction. Further cold drawing did not result in any appreciable increase in this concentration. [100] orientation showed no significant change with increasing cold

work, however, a slight decrease at higher reductions was noted.

The usual assumption of random orientation around the fibre axis in cold drawn metals was found to be incorrect, due to the presence of residual textures in starting material. The texture within the specimens varied considerably, indicating non-uniform deformation during cold drawing.

Recrystallization developed no new orientations. Annealing produced various sharpenings and weakening in [111] and [100] orientations. No general and far reaching trend was observed, except that on annealing at 800°C both orientations were considerably weakened.

Concentration of both orientations in cold drawn specimens first decreased from a maximum at the fibre axis to a minimum near mid-radius, and then slightly increased with increasing distance from the fibre axis. Annealing up to 800°C retained this general distribution of [111] texture but it was destroyed after a 1000°C anneal. Distribution of [100] texture became random after annealing at 800°C.

Hardness in the 20.6 per cent cold drawn specimen increased only to a distance of 0.1 inch from fibre axis. At the two higher reductions hardness increased from a minimum at center to a maximum near mid-radius, again decreasing towards the rod surface. Outer regions of the specimens showed a maximum rate of dissolution in concentrated nitric acid, indicating maximum deformation of these zones during cold drawing. No significant variation in microstructure across the cross-section of the three cold drawn nickel rods was observed. Recrystallization at 800°C followed by grain growth at 1000°C was observed.

241 pages. \$3.01. MicA 55-149

FOOD TECHNOLOGY

TOMATO JUICE FILM DEPOSITION ON HEAT EXCHANGER COILS

(Publication No. 10,439)

Harold Willard Adams, Ph.D.
University of Illinois, 1954

The primary purpose of this research was to study the factors affecting tomato film deposition of tomato juice on steam-heated coils during atmospheric concentration. A pilot model atmospheric cooker was constructed from a small stainless steel tank. Two banks of coils were installed at the bottom of this cooker. Three sets of metal coils were tested, which were fabricated from copper, stainless steel, and nickel. The copper coils were used in most of the runs.

The research studies showed that film deposition

of high temperature hot broken tomato pulp was prevented by heating the juice, with direct steam injection, to a temperature and steam pressure which corresponded to 40 psig and holding the juice at this temperature for a period of one minute. After this treatment the juice was concentrated without film deposition on the heating coils.

Experimental studies showed that the filming problem could be reduced by certain special treatments or procedures. In one method, high temperature hot broken tomato pulp was pre-heated or boiled for four minutes. This was followed by draining the pulp from the cooker and cleaning the tomato film from the heating coils. The film was easily removed at this time, and when the pulp was returned to the cooker it was evaporated without further film deposition. Silicone grease was applied to the heating coils which resulted in an easier removal of the

tomato film. However, a film was deposited on the coils and the rate of heat transfer was drastically reduced when silicones were used. Neither of these methods prevented film deposition. They merely aided in film removal or made possible much better heat transfer from the coils during the major part of the concentration.

Studies concerning the filming tendencies and rate of heat transfer were made on various degrees of hot broken tomato juice. The tomato pulp was hot broken in the range from 140° F. to 210° F. When the tomato pulp was hot broken above 180° F. the subsequent evaporation was usually characterized by film deposition on the heating coils. Hot breaking temperatures below 180° F. usually did not foster film deposition, and as the hot breaking temperature was lowered towards 140° F., the rate of heat transfer was increased.

Reduction of the fiber particle size of high temperature hot broken pulp generally increased the

problem of film deposition. A study was made which showed that the filming tendency of tomato pulp resulted from the fiber rather than the serum portion of the juice.

Treatment of high hot break tomato pulp with various pectic enzymes was investigated. Some enzymes or combinations of pectic enzymes when added to tomato juice prevented film deposition. However, the enzyme treatment which prevented filming reduced the viscosity and increased the weeping of the concentrated product. Proteolytic enzymes were tested and did not inhibit film deposition.

The over-all heat transfer coefficients were exceptionally high in the pilot cooker. The most satisfactory explanation for this seemed to be in the hemispherical bottom of the cooker. Evidently a high induced velocity of the evaporating liquid was caused by the shape of the bottom of the cooker.

130 pages. \$1.63. MicA 55-150

GEOLOGY

THE REVERSIBLE DEHYDROXYLIZATION OF THREE-LAYER CLAY MINERALS

(Publication No. 10,496)

Edward Charles Jonas, Ph.D.
University of Illinois, 1954

The apparatus for controlled atmosphere differential thermal analysis was adapted to the reconstitution of thermally dehydroxylated three-layer clay minerals. A three-layer clay mineral that had been heated to 750° C and cooled in an atmosphere of water vapor developed, by the rehydroxylation reaction, a rehydrate form of the clay mineral. The rehydrate has the same composition as the original clay from which it was synthesized, but it has a structure similar to the anhydride form.

DTA of the synthetic rehydrate form show that its hydroxyl water is lost at a temperature considerably below that of the original clay. X-ray diffraction data show similarities to the original clay in line intensities and similarities to the anhydride form in line spacings.

The synthetically prepared rehydrate was observed to revert to the original clay structure in a very slow reaction. The entire cycle of reversible dehydroxylation consists of the formation of the anhydride which rehydroxylates to form the rehydrate. The rehydrate then spontaneously reverts at room temperature to the original clay.

The similarity between the DTA curve of the rehydrate and the low temperature part of a double-peaked montmorillonite suggests that double-peaked montmorillonites may be natural mixtures of the rehydrate form and the true montmorillonite. The

rehydrate form could not, except under rare conditions, be developed in nature as it was in the laboratory. It is suggested that most natural occurrences of the rehydrate result from its formation as an intermediate product in the devitrification of volcanic ash. The proportions of rehydrate and ordinary montmorillonite in the mixture would be related to the degree of completion of the reversion reaction from rehydrate to the ordinary montmorillonite structure.

69 pages. \$1.00. MicA 55-151

THE GASTROPODS OF THE LATE CRETACEOUS RIPLEY, OWL CREEK, AND PRAIRIE BLUFF FORMATIONS

(Publication No. 10,549)

Norman Frederick Sohl, Ph.D.
University of Illinois, 1954

A gastropod fauna consisting of 127 genera and 306 species from the Late Cretaceous (Maestrichtian) Ripley, Owl Creek, and Prairie Bluff formations of Tennessee and Mississippi is described. Of the total five genera, one subgenus, 61 species and five varieties are described as new.

The gastropods appear to indicate a shallow warm water environment (20-80 fathoms) which was rich enough in organic material to allow a great diversification of form. The other molluscs, the pelecypods and cephalopods, also seem to support the above view as do the bedding features and

lithology of the fossiliferous beds. At other times this environment was replaced by mud flat and shallower near-shore environments which did not afford ample opportunity for the development or preservation of so great a fauna.

The oldest formation is the Ripley which in Tennessee is approximately 400 feet thick but thins greatly to the south. At the base the formation is transitional with the Selma chalk and is overlain unconformably by the Owl Creek formation. The middle member of the formation, the McNairy sand member, comprises most of the thickness in the north but pinches out southward in Union County, Mississippi. This member is relatively unfossiliferous and bedding structures indicate a shallow water origin. The Owl Creek formation overlies the Ripley and is bounded both above and below by unconformities. It is a relatively thin formation seldom more than 45 feet thick and consists of fossiliferous sands which become increasingly calcareous to the south where in Pontotoc County the formation grades into the Prairie Bluff chalk. The Prairie Bluff chalk becomes less contaminated to the south but remains relatively thin. The chalk is fossiliferous but with the exception of the oysters, the mollusca are preserved only as phosphatic casts and molds.

Detailed stratigraphic sections and a summary of

previous paleontological and stratigraphic work done in this and adjoining areas is also included.

The fauna of the three formations is compared, and the great similarity of the Owl Creek and Prairie Bluff gastropod fauna is noted. Evidence is presented which indicates that the facies change from sand to chalk deposition did not prove a great barrier to the intermingling of the gastropods between these two areas of deposition.

The gastropod fauna of these formations is compared to their equivalents on the Gulf Coast area and evidence is presented for a correlation of the Owl Creek formation with part of the Kemp clay of Texas and the Providence sand of Alabama. Finally, in tabular form and by discussion comparisons are made with correlative deposits of other continents. It is pointed out that the Gulf Coast region in Upper Cretaceous times bears the greatest similarity, in terms of analogous species, to the Pondoland, South Africa deposits. Genera such as *Calyptraphorus*, and *Pugnellus* indicate relationships with the Pacific areas during the Upper Cretaceous. The cosmopolitan Gulf Coast fauna bears relationships with many areas. Comparisons are also made with the Tertiary fauna of the Gulf Coast.

551 pages. \$6.87. MicA 55-152

HEALTH SCIENCES

HEALTH SCIENCES, PUBLIC HEALTH

A COMPARISON OF THE EFFECTIVENESS OF TWO METHODS OF INFLUENCING CERTAIN OBESE COLLEGE STUDENTS TO ATTAIN AND MAINTAIN "IDEAL" WEIGHT

(Publication No. 6274)

Elizabeth Ann Douglass Munves, Ph.D.
New York University, 1953

Chairman: Henrietta Fleck

Obesity is designated as America's number one health problem. Research indicates the need for the development of effective ways to instruct the obese individual about weight loss. The present investigation proposes to compare the effectiveness of two methods, dietetic interview and discussion-decision, of influencing obese college students to attain and to maintain "ideal" weight.

A dietetic interview was interpreted to take place when each subject receives individual weight loss instruction from the nutritionist. A discussion-decision exists when a group of individuals is guided by the nutritionist to discuss the problems associated with obesity. This discussion leads to the setting up

of definite goals for action by each member for himself in the group setting.

The medical staff at the Health Service selected forty-eight obese students between the ages of seventeen and twenty-seven to participate in this investigation. Fourteen women and ten men were subdivided into four discussion-decision groups and fourteen women and ten men comprised the dietetic interview group. The investigator acted as the nutritionist throughout the study. The investigation lasted eight months. This was subdivided into two periods: the first four months were devoted to teaching and the second four months were considered as a maintenance period without nutrition consultation. At the end of eight months the subjects were recalled for a follow-up study.

The basal metabolic rate was determined once and the hemoglobin value three times: initially, mid-way, and terminally. The actual weight loss was obtained every two weeks and was plotted graphically against the predicted weight loss of each subject. No weights were obtained during the maintenance period. The food records were rated three times: initially, mid-way, and terminally. The investigator kept progress notes of the dietetic interview and the discussion decision meetings as well as a record of the amount of time spent teaching subjects. In the

follow-up study each subject evaluated the method of instruction received.

The performance index, the actual weight loss of subjects expressed as the per cent of the predicted weight loss of subjects, was analyzed to determine whether a significant difference existed between the two groups. There was no statistically significant difference shown between either the means or the distribution in terms of variability of the dietetic interview and the discussion-decision. The mean performance index demonstrated that the discussion-decision was as effective as the dietetic interview in attaining weight loss while the dietetic interview was more effective than the discussion-decision in maintaining weight.

The performance indexes were interpreted in regard to various factors believed to influence weight loss. No appreciable influence was detected. The food records were rated both quantitatively and qualitatively. Because of wide variations in ratings, no

conclusions were made concerning food habits and weight loss. The hemoglobin values were useful as an indication of the general health of subjects, but the data were too limited to be used as a check on the nutritional status of subjects.

The findings of this research have many implications for clinical research. Discussion-decision may be used to teach many clinical groups. Educational research is indicated by the need for further development of the discussion-decision method. Other implications for educational research include the training of leaders, the development of screening devices, and the exploration of methods, techniques, and audio-visual aids for various kinds of groups.

The investigator found the discussion-decision a practical and effective approach to the problem of weight loss. Through increased use and additional research discussion-decision may become even more effective in the attainment and maintenance of weight loss.

274 pages. \$3.43. Mic 55-4

HISTORY

HISTORY, GENERAL

THE WILSON ADMINISTRATION AND ORGANIZED LABOR, 1912-1919

(Publication No. 10,589)

Dallas Lee Jones, Ph.D.
Cornell University, 1954

When Woodrow Wilson assumed the presidency, he did so with certain definite ideas regarding labor. Chief among these ideas were a willingness to accept the labor movement, the belief that men should have the right to organize and to bargain collectively, and the belief that some protective legislation was necessary to protect workers from those industrial evils against which they could not protect themselves. These ideas formed the basis of the labor policy of his administration.

Wilson's acceptance of the organized labor movement was revealed in many ways. One of the important results of that acceptance was the appointment of men friendly to labor to those positions which dealt with labor matters. For example, William B. Wilson, a trade-unionist of long standing, was appointed Secretary of the newly created Department of Labor. Secretary Wilson's philosophy gave to the Department a direction which it has never lost. During the war, labor representatives were appointed to many of the important government agencies, thus giving to labor a recognition equal to that of business.

The right of labor to organize involved several problems of which the two most important were: the legal right of labor to organize and pursue its

objectives, and the right to organize as involved in dispute settlement.

The legal right of labor to organize was especially involved in the Clayton Act controversy. Although labor expected substantial aid from President Wilson in securing exemption from the Sherman Antitrust Act, that aid did not materialize. Instead, the President's attitude prevented the passage of a clear-cut provision providing such exemption. Although Wilson believed that there should be no doubt about labor's right to existence, he believed that complete exemption of labor from the jurisdiction of the act would be inimical to the general welfare. On the other hand, indictments against labor involving the right to organize were dropped, although a few years later similar cases were decided against labor. During the war, the administration actively supported the right of labor to organize in spite of Supreme Court decisions that gave employers authority to prevent employees from enjoying that right.

The right of labor to organize and to use a strike to compel employer recognition of the union was also upheld by the Wilson administration from the bitter Colorado coal strike of 1913-1914 to the steel strike of 1919. With the exception of the latter struggle, after the President became ill, the administration took no action that deprived workers of their rights.

The Wilson administration also coincided with the culmination of the movement among the railway Brotherhoods in 1916 for nation-wide bargaining. As a result, Wilson was faced with a "national emergency" dispute. Inevitably, he assumed the role of mediator, and, in so doing, he set several important

precedents. From this controversy emerged the Adamson Act – an act which provided the final impetus to establish the eight-hour day as the standard workday.

The Wilson administration brought to fruition many protective measures for which labor had long been struggling. Among these measures were the LaFollette Seamen's Act of 1915, the Keating-Owen child labor law of 1916, and the Kern-McGillicuddy workmen's compensation act of 1916.

In the post-war period, labor believed that Wilson became unfriendly to labor. Actually, there was little change in the President's attitude, but during his illness in the fall of 1919, the administration was directed by men who viewed labor with suspicion. For all practical purposes, the Wilson administration ended in the fall of 1919 with the settlement of the bituminous coal strike.

520 pages. \$6.50. MicA 55-153

MISSOURI, THE TWELFTH CONFEDERATE STATE

(Publication No. 9184)

Arthur Roy Kirkpatrick, Ph.D.
University of Missouri, 1954

In March, 1861, the Missouri State Convention, meeting in St. Louis, decided that there was "... at present no adequate cause to impel Missouri to dissolve her connection with the Federal Union." This decision was undoubtedly in accordance with the will of the great majority of the people of Missouri at that time. It was, however, made before the fall of Fort Sumter, the capture of Camp Jackson, and the occupation of Jefferson City by General Nathaniel Lyon, events which turned many a March Unionist into an April, May or June Secessionist.

Governor Claiborne F. Jackson, who had worked for the secession of his state from the election of Lincoln, evacuated the state capital on June 13. He and small units of the state militia suffered defeat at Lyon's hands four days later at Boonville. By the time the Convention had reconvened and had outlawed Jackson's government on July 30, the Governor was in Richmond securing promises of Confederate financial and military aid. On October 28, 1861 the General Assembly, called into session at Neosho by Governor Jackson, declared Missouri a free and independent state. On November 28, by resolution, the Confederate Congress admitted Missouri as the twelfth Confederate state.

In the following three and one half years Missouri's fugitive government was to be found in a number of locations in Missouri, Arkansas, Louisiana, and Texas. Under Governor Jackson it was driven from the state and its officers and records were widely scattered. After Jackson's death in Little Rock, Arkansas in December, 1862, Lieutenant Governor Thomas C. Reynolds took the reins in his able hands. Reynolds not only gathered the fragments of his

government together, collected money long overdue from the Confederacy, and paid the creditors of the state for the first time, but worked constantly to maintain amicable relations with Sterling Price. First in Richmond, and later in Jackson, Mississippi, in Camden and Little Rock, Arkansas, and in Marshall, Texas, he made important friends for Missouri. A firm friend of President Davis, he cooperated closely with the administration, and appointed only Davis supporters to state positions and to the Confederate Senate.

Although his attempt to return to Jefferson City in the autumn of 1864 failed when General Sterling Price was defeated and forced to retreat, Reynolds continued to head a solvent and active state government, with Senators and Representatives in Richmond until General E. Kirby Smith surrendered his Trans-Mississippi Army on May 26, 1865.

390 pages. \$4.88. Mic 55-5

HISTORY, MODERN

A STUDY IN THE LIBERATIVE MOVEMENT OF IRAQ, 1908-24

(Publication No. 9568)

Abdul Qadir Ahmad al-Yoosef, Ph.D.
State University of Iowa, 1954

Chairman: Professor W. Ross Livingston

The Liberative Movement of the Arabs of Iraq started as a reaction against the secularizing and the Turkeyfying tendency of the Committee of Union and Progress. It was generated by the Arab nationalists, the spiritual leaders of the Holy Iraqi towns and the militant tribal shaikhs of the Middle and Lower Euphrates Valley.

The Arab nationalists constituted the core of the movement. Up to 1914 the Arab nationalists of Iraq in conjunction with Arab nationalists of other Arab provinces of the Ottoman Empire aspired to an autonomy within the Empire.

World War One, however, provided an occasion for the Arab nationalists to work for complete severance from the Turks. The Husain-McMahon Correspondence was understood by the leaders of the nationalists as the British guarantee for a future Arab independent state as had been indicated in the Protocol of Damascus in 1915. The situation led the leaders of the nationalists to break away from the Turks and to ally themselves with the British.

The Protocol of Damascus turned out to be a scrap of paper. Throughout the war Great Britain followed an inconsistent policy regarding the Arabs. British officials in Egypt who engineered the plan of Anglo-Arab cooperation and who instituted the Arab Bureau for the execution of the plan were contradicted by British officials in Iraq. The latter

represented the views of the India Government that stood against any commitment to the Arabs regarding the future status of their countries. They followed a policy the gist of which was to provide the indigenous population of the occupied territories in Iraq with "a good government" as a prelude to converting Iraq into a "British Protectorate." Meanwhile, the British Foreign Office not only neglected to coordinate the activities of the Arab Bureau and the India Government but complicated the situation by embarking on an inconsistent course as manifested in the Sykes-Picot Agreement, 1916; the Balfour Declaration, 1917; the Declaration to the Seven Arab Nationalists, 1918, and the Anglo-French Declaration, 1918.

These policies of the British together with the imposition of the mandates on the "Fertile Crescent" broke down the unity of the Arab nationalists and transformed their movement into Lebanese, Palestinian, Syrian and Iraqi particularistic ones, each of which aimed at the emancipation of its individual country from the mandate.

The spiritual leaders of the holy towns of Iraq constituted the second important element of the Liberative Movement of the Arabs of Iraq. They were aware of the fact that "nationalism" was incompatible with the "universality" of Islam; nevertheless, they joined themselves with the nationalists for the legal purpose of defending their religion. They denounced and combatted the practices of the Committee of Union and Progress as being flagrant violations of Islamic tradition. The British Administrative System, 1914-20, and the "British Mandate," 1920, were resisted as being non-Arab and non-Moslem. Here again spiritual and temporal considerations overlapped each other and the dignitaries found themselves in accord with the nationalists in refusing to acquiesce in the British tutelage. The spiritual leaders held supreme authority in the rural areas of southern Iraq and enjoyed the reverence and even the obedience of a considerable number of tribal shaikhs.

The militant tribal shaikhs of the Middle and Lower Euphrates Valley formed the third element of the Liberative Movement. In fact the majority of the shaikhs had mediocre or imperfect notions about the essence and the ultimate design of the struggle of the nationalists. What concerned them most was the salvation of the soul and the preservation of their local privileges. A strong centralized government was considered as repugnant as the non-Arab and the non-Islamic control. The spiritual leaders served as the proper medium of understanding among the shaikhs and the nationalists.

Consequently, the most significant unifying factor among the nationalists, the spiritual leaders and the shaikhs was the apprehension of foreign and non-Moslem rule. The concerted efforts of these leaders constituted the part and parcel of the Liberative Movement.

The British Mandate over Iraq proved to be the touchstone of the alliance of the three groups of leaders. The period 1920-24 witnessed the disintegration and the transformation of the Liberative Movement. This could be attributed partly to the

quelling of the Iraqi Insurrection, 1920, that aimed at the expulsion of the British from the country and partly to the reconciliatory policy of the "mandatory power" regarding the nationalists as manifested in the instituting of an Iraqi national government and the accession of the Amir Faisal to the Iraqi throne.

Gradually, a considerable number of influential nationalists were attracted to the British policy and accommodated themselves to the conditions of the mandate. These nationalists became in time the leaders of a new liberative movement aimed at the termination of the British mandate through normal diplomatic channels as a practical step on the way to a prospective Arab unification.

An attempt was made to use both English and Arabic sources. Government publications, newspapers, collections of correspondence and other materials were utilized.

Among the reports of the British Government the following were of importance for the period 1914-24; "Review of the Civil Administration of Mesopotamia, 1914-1920," Cmd. 1061 in the *British Accounts and Papers*, Vol. LI (London, 1920); *Iraq, Report on Iraq Administration, October, 1920-March, 1922* (London, 1922); and *Report by H. M's. Government on the Administration of Iraq, April, 1923-December, 1924* (London, 1924). *Mudhakar al-Majles al-Ta'asisi al-Iraqi* (Minutes of the Iraqi Constituent Assembly) 2 Vols. (Baghdad, 1925) contains illuminating information regarding the view of the nationalists on the Anglo-Iraqi relationships in 1924.

Arnold Wilson's two works, *Loyalties, Mesopotamia 1914-17* (London, 1930) and *Mesopotamia 1917-20* (London, 1931) were helpful in respect to the British policy in Iraq.

Abdul R. al-Hasani, *al-Thowra al-Iraqia al-Kubrah* (The Great Iraqi Revolution) (Saida, 1952) contains valuable documents concerning the relations among the religious leaders and the tribal shaikhs.

M. al-Bassir, *al-Qadhia al-Iraqia* (The Iraqi Question) (Baghdad, 1923) and S. Fedhi, *Fi Ghumrat al-Nidhal* (In the Midst of the Struggle) (Baghdad, 1952) are indispensable because both authors were actual participants in the Liberative Movement.

168 pages. \$2.10. MicA 55-154

PENNSYLVANIA'S MOBILIZATION FOR WAR, 1860-1861

(Publication No. 9967)

Edward George Everett, Ph.D.
University of Pittsburgh, 1954

This is a study of the progress of a state from conciliation to action in the period from 1860 to 1861. In scope it deals with the crystallization of war sentiment, the mobilization of troops, the organization of civilian agencies, the evolution of the military problems of a border state, and the marshalling of finance and industry in Pennsylvania.

To present the picture of Pennsylvania in war one

must delve beneath the surface of statistics of a state to reach the lower levels of localities, counties, and regions. This picture is presented only through the study of state records, journals, diaries, letters, and a segment of the 320 newspapers that were published in this state in 1861. Only then can one understand the remnants of colonialism, provincialism, and agrarianism that existed within Pennsylvania in the war years; each county therefore operated as a separate unit to solve problems arising out of the war. Yet at the same time spheres of influence radiated from Philadelphia, Harrisburg, and Pittsburgh into adjacent counties and regions.

Certain conclusions present themselves. In essence the study of a nation's arming for war becomes the study of 23 separate state governments and the relations of these units with the nation's capital. Out of this pattern of relationship comes one major conflict: states' rights versus nationalism.

At the beginning of the war the initiative of organization was taken by the state governments, not the nation, and Pennsylvania ranked high with the national government at Washington. Emanating from Harrisburg was a positive leadership that mobilized a state for war. The success of Pennsylvania's preparation for war is found in the efficient manner in which the impulse of needs and commands was radiated from Harrisburg to the farthest counties, and in these counties the center of organization proved to be the county court houses. A hierarchy of command was initiated that reached into villages and towns. From this pattern there evolved a homogeneity of war sentiment that found expression in raising troops, taking care of families of volunteers, suppressing contraband, providing for home defense. All in all the model that developed was localism and sectionalism, in strange contrast with the strong centralization and nationalism of today.

In Pennsylvania, as in other states of the North, two types of relief agencies arose: national and independent. But whether the relief agencies were national or independent there still remained a basic pattern of localism in organization.

Probably Pennsylvania's greatest contribution to the Union was in finance and industry. The factory system and consolidation of big business were riveted on the economy of the state. Contrary to the local pattern of raising troops and forming public opinion, finance and industry escaped the confines of localism to take on the beginnings of interstate contracts and consolidation.

One point becomes evident in the study of Pennsylvania from 1860-1861. This year laid down the foundation of the state's remaining years in war. Basically the pattern did not change; if there is a degree of difference in the state's reaction to the latter days of the war, it is not a degree of changing patterns, merely a decline of enthusiasm for war. One major attempt was made to alter the localism and states' rights theory in war, and that was the attempt to develop a national conscription. In actuality, however, the Federal government still used local agencies to attain such an end. Therefore throughout the war the underlying conflict between

Pennsylvania and the national government was a principle of ideology: localism and states' rights versus nationalization and centralization of powers.

289 pages. \$3.61. MicA 55-155

CHARLES EVANS HUGHES
AND NICARAGUA, 1921-1925

(Publication No. 9726)

Virginia Leonard Greer, Ph.D.
University of New Mexico, 1954

Charles Evans Hughes, as Secretary of State, inherited a perplexing policy of United States intervention in the political and economic life of Nicaragua, dating primarily from the overthrow of the Zelaya regime in 1909. The State Department had approved an American collector-general of Nicaragua's customs, and had appointed two of the three members of the Nicaraguan High Commission which supervised the government's expenditures. A United States legation guard of about one hundred marines, retained in Nicaragua since 1912, was a visible sign of intervention.

Major objectives in Hughes' policy toward Nicaragua included the maintenance of peace and stability, the establishment of a representative, freely elected government, and the withdrawal of the legation guard. His efforts to settle the boundary disputes and to establish political stability within Central America by means of conferences were unavailing, and the period 1921-1925 was marked by revolutions and border incidents.

Hughes was successful in his efforts to have Nicaragua adopt an American-drafted electoral law and agree to American supervision of registration prior to the election of 1924. His belated opposition to the candidacy of the Nicaraguan president to succeed himself in office, however, had unfortunate results. The resentful official not only refused to permit United States supervision of the elections but, through executive decrees, invalidated the safeguards provided under the electoral law. Rather than insist upon a new election which might necessitate the use of force by the United States, Hughes recognized the government thus designated.

Nicaragua's fiscal problems in 1921 and 1922 were complicated by a severe depression. Pressed for funds the Nicaraguan government demanded the reserve funds held by the collector-general of customs and the resident high commissioner. Hughes, in strict observance of the contracts and financial plans negotiated through the Department of State by Nicaragua and private American interests, denied that the American officials, in the observance of their duties, were subject to orders issued by the president of Nicaragua; neither were they to be regarded as subordinate employees of the Nicaraguan government. The secretary of state's stand was equally firm regarding the impropriety of United States intervention in Nicaragua's negotiations to

secure control of the National Bank when the sale involved no encroachment upon the rights of Nicaragua's creditors. Hughes maintained that there was no violation of treaty or contract rights in the negotiations for the bank's sale and that Nicaragua, as an independent nation, was free to administer its domestic affairs.

Hughes was successful in negotiating a most-favored-nation trade agreement with Nicaragua although he found it advisable first to consult private American banking interests. It was his policy to help Nicaragua economically and to promote American enterprise and investments in that republic. He insisted, however, that Nicaragua be free to negotiate loans in its own best interests.

Although Hughes was a man of recognized statesmanship in world affairs, his conduct of the foreign relations of the United States with Nicaragua did him little credit. He attempted to promote peace but sought, nevertheless, to avoid the discussion and settlement of major Central American problems. His determination not to interfere in Nicaragua's pre-election activities thwarted his attempts to insure a free election. The indecisiveness of his policy is demonstrated in his last minute, reluctant recognition of the Nicaraguan government elected in 1924. The causes for his hesitancy and uncertain policy lay not only in State Department commitments, made prior to 1921, which blocked his efforts to curb American intervention in Nicaragua, but were also the result of inadequate information and unwise advice.

203 pages. \$2.54. MicA 55-156

THE PRIVY COUNCIL UNDER THE EARLY TUDORS

(Publication No. 10,492)

James Frederick Hood, Ph.D.
University of Illinois, 1954

English monarchs had been assisted by a body of advisers since the days of the Anglo-Saxon Witan. During the Middle Ages, this council generally reflected one of two things: the desire of the territorial magnates to provide a check on the royal power or the counter desire of the monarch to provide himself with loyal and efficient civil servants.

By 1485, as a consequence of the internecine struggles of the fifteenth century, English kings were still unprovided with any definite, sworn body of advisers. The reign of Henry VII saw the beginnings of a differentiation of functions among the members of the royal council, particularly with the formation of the Court of Star Chamber. This followed in the tradition of the Middle Ages, when other agencies of the royal government had evolved from the larger royal council, agencies like chancery.

From the beginning of the reign of Henry VIII, there is a consistent body of evidence which indicates the tacit formation of a select executive group of sworn privy councillors. This small group, averaging about twenty members, assumed the direct

administration of both policy-making and day-to-day work of the government. This arrangement was formalized on 10 August, 1540, with the resumption of official records and minutes of the meetings. The group set a high standard of efficiency all during this reign.

With the accession of Edward VI there begins a period of breakdown in the system of conciliar government. This crisis, however, was precipitated by a failure of the monarchy rather than of the council. Under both Edward VI and Mary, the size of the council was much increased. Since the council was forced to supply the executive motivation as well as the practical application of government, it became a jousting ground for rival factions, especially in the field of religion, with Gardiner and Cranmer being the principal opponents under Edward VI.

Under Mary, the dominant faction, led by Paget, was forced to constitute itself an informal privy council for the effective conduct of business. The councillors proved most recalcitrant in carrying out the wishes of Mary and Philip and forced some drastic alterations in the religious and political policies which the crown wished adopted.

In the early years of Elizabeth, a return was made to the methods of government by a council closely controlled by the crown which had been in effect under Henry VIII. For the first time since the 1540's, some degree of stability and loyalty was restored to the executive function of the government.

254 pages. \$3.18. MicA 55-157

LEWIS BALDWIN PARSONS AND CIVIL WAR TRANSPORTATION

(Publication No. 10,542)

George Carl Schottenhamel, Ph.D.
University of Illinois, 1954

Soon after the guns at Fort Sumpter announced the outbreak of civil war Lewis Baldwin Parsons put aside his plans for a life of ease and semi-retirement at the age of 42 and entered the service of his country. His years as a railroad executive had given him a good foundation in the management of transportation systems and at the same time had earned for him a wide acquaintanceship among the country's most influential men.

Soon after entering the service he found the Transportation Department in the West to be in a state of utter confusion, and totally incapable of supporting any major move by the armies. With great patience he achieved order out of chaos, removing railroads and steamboats from the control of unauthorized army personnel who deemed it the prerogative of their uniforms to devote the country's transportation to their own personal service. Firmly endowed with a strong faith in private enterprise Parsons had nothing but suspicion for a system of transport dominated by government ownership and control. Enlisting the cooperation of railroad and steamboat interests

he insisted that both government and private transportation should be carried on the same basis. With a watchful eye toward economy he introduced into the government's transportation service the principles he had learned as the general manager of a midwestern railroad before the war.

The transportation of the Civil War was not carried exclusively by railroads, steamboats or by horse and wagon. Supplies were moved and armies were shifted from one part of the country to another by means of all of these agencies acting in conjunction with one another. It was Parsons' task to coordinate the work of railroads and steamboats so that the grain raised in the West and the shoes made in the East reached the soldier fighting in the South. Where trains were best able to furnish transportation he used them almost exclusively. South of Cairo, Illinois it was the steamboat's turn to become the prime mover for both troops and supplies.

It was not by chance that the movement of the Union Armies in the West followed along the Mississippi River and its tributaries. Union generals were quick to recognize the advantage of moving their troops by river transportation which enabled the men to go into battle in good physical condition. As in the case of Island Number Ten the river was often the means of obtaining a position by the simple tactic of by-passing it.

Even more important were the rivers as a means of supply. Nothing could equal a navigable stream as a supply route for troops in the field. But the ideal was not always available. In that case rivers like the Tennessee, shallow, treacherous and thoroughly unpredictable as it proved to be, were of inestimable value. The Cumberland, navigable for about five months in the year, was used under Parsons' direction to accumulate in Nashville the provisions to subsist Sherman's Army on its march to Atlanta.

In the efficient transportation system developed by Parsons and others of his caliber the North possessed a great advantage over its adversary. An army of twenty thousand men was moved from one field of battle to another a thousand miles away in little more than ten days. Movements of this type marked the beginning of the importance of logistics in modern warfare where transportation plays such an important part. If victories in the realm of transportation were given the same acclaim as those on the field of battle, the name of Lewis Baldwin Parsons would be one of those most honored and remembered in connection with the American Civil War.

402 pages. \$5.03. MicA 55-158

FATHER ANSELM WEBER, O.F.M.,
MISSIONARY TO THE NAVAHO, 1898-1921

(Publication No. 9730)

Robert Leo Wilken, Ph.D.
University of New Mexico, 1954

In this biography of a modern Catholic missionary among the Navaho Indians insight is given on the problem of cultural infiltration.

Anselm Weber of the Order of Friars Minor was a contemporary missionary, born 1862 in New Salem, Michigan, who died in 1921, after spending twenty three years in the Southwest as founder and organizer of the Catholic Navaho mission of St. Michaels, Arizona.

After an initial five-year period spent in conventional proselytizing approaches, the missionary learned to refocus and reshape his mission plan. To convert the Navaho to Christianity, he progressively concluded, would involve either a cross fertilization of Navaho ways of life by culture traits of Western Civilization, or would require a complete disintegration of Navaho culture which would be supplanted by a new way of life embodying Christianity.

Basic to such a missionology was the language. Concepts and thought patterns of the Navaho proved at times utterly uncongenial to translation in modern European language, and conversely. Accordingly ethnology, archeology, and anthropology were pressed into serving the linguistic effort. Within fifteen years the mission published its first Navaho language and ethnological studies, the first of a shelf of recognized scientific works published at St. Michaels Mission.

From the central mission at St. Michaels where Mother Katharine Drexel founded a boarding school in 1902 Anselm Weber branched out to found mission outposts at strategic points in the vast expanse of the reservation. Geography accentuated the general mission problem. Navaho country embraces desert, upland plain, bad lands, and mountainous terrain. Rainfall is extremely light, varying between six inches annually in the plains to twenty inches in the mountain areas above eight thousand feet elevation.

As farmers and herdsmen the Navaho are forced to live widely separate as small bands and outfits along washes, springs, and the few live streams that permit irrigation. Forage for sheep, goats, and cattle is scant except in the higher altitudes.

Combining with terrain, social structure and political organization of the Navaho make for scattered family groups rather than clustered villages. Little, if any, centralized political control obtains within the tribe. Social control within family and outfit is highly democratic.

Navaho religious practice and belief derives from ancient myths concerned with the origin of the Navaho People from a race of supernatural Holy People whose earlier ways and procedures set the pattern for earth-surface people. Religion is largely concerned with maintaining balance individually with a pre-existent order. Sickness and trouble result from deviation from this cosmic order and harmony. Harmony once disturbed can be reestablished through the

medium of chants and dances. Moral guilt is vague and an organized dogmatic theology nonexistent.

Anselm Weber gained the lasting trust and affection of the Indians through his selfless socio-economic work in their behalf. As surveyor, lawyer, and spokesman with the government on land and educational matters, he helped to broaden Navaho lands and to direct government attention to basic economic and social problems of his adopted People.

Under his leadership the Franciscans returned to mission work among the Zuñi, Santo Domingo, Jémez, and neighboring Pueblo Indians. He was likewise responsible for the acceptance by the Friars of parishes and missions at Peña Blanca, Jémez, Roswell, Clovis, Gallup, Farmington, Lumberton and Parkview, New Mexico.

Direct conversion among adult Navaho was rare.

Graduates of boarding schools who had been baptized and educated as Catholics very frequently reverted to paganism after returning to camp life. Notwithstanding, a small core of Catholic Navaho formed over the years and continued to grow, particularly where conditions made for concentration of population.

After repeated operations and treatment for cancer, lasting over a period of five extremely active years, Anselm Weber died at Rochester, Minnesota, March 8, 1921, deeply loved and mourned by Indians and whites.

Unpublished letters, papers, and journals, found in various archives and collections, made up the bulk of the source materials upon which this biography is based. Other primary sources, public documents, and secondary materials rounded out the document.

395 pages. \$4.94. MicA 55-159

HOME ECONOMICS

ECONOMIC CONTRIBUTIONS GIVEN TO AND RECEIVED FROM INDIVIDUAL MEMBERS OF FAMILIES AND HOUSEHOLDS IN RELATION TO THEIR FINANCIAL SITUATION

(Publication No. 10,591)

Marjorie May Knoll, Ph.D.
Cornell University, 1954

An attempt was made to study the contributions made to and received from households by persons 14 years of age and over living within the households and those living outside but interacting economically with them. Differences between rural and urban families and in some cases between rural farm and rural non-farm families were studied. The contributions studied were: 1) possible money contributions, 2) actual money contributions, 3) goods provided and 4) work done for the household. The receipts considered in this study were: 1) money, 2) food, 3) shelter, 4) clothing, 5) recreation, 6) transportation, 7) care when ill and 8) lunches prepared and carried from home.

Data for this study were obtained through interviews with 202 randomly selected families, 98 in the city of Cortland, New York, and 104 in the rural area outside the city limits. Forty-five of these households reported either receiving from or contributing to persons who did not live in the households.

Heads and spouses, assumed to be primary earners and contributors, represented almost three-fourths of all persons 14 years of age and over who lived in the households. Children and older persons, assumed to be lesser earners and contributors, comprised less than one-fourth of the group of which older persons represented less than five per cent. The number of persons living outside and interacting with rural households was nearly twice that interacting with urban.

The money income of male primary contributors (\$3,500. annually) was about three times that of female primary contributors. The primary contributors gave all or nearly all of their incomes to the household. The average income of children was similar to that of female primary contributors but that of older persons was less (about \$600. annually). While older persons had less to contribute in money than children, proportionately more of them gave of it to the households.

Responsibility for care of the family's clothing, care of the house, food preparation and dishwashing was taken mainly by the female primary contributors. One-half of the women assumed full responsibility for the work in these areas. Approximately three-fourths of the male primary contributors and children helped with chores and gardening or driving for the household. Few assumed total responsibility for work in any area. More older persons than children contributed work in dishwashing and food preparation and one-fifth of them took the entire responsibility for work in these two areas. The care of family members was shared by all family members and few claimed full responsibility for it.

One-half of the children who lived outside the households and interacted economically with them helped in caring for family members and in driving for the households. Parents interacting with rural farm households particularly helped to care for family members and to a lesser extent helped with food preparation and care of the house.

The persons who lived in the households received all their meals and sleeping quarters from the households. In addition male and female primary contributors received nearly all of their clothing, recreation and transportation. One-half of them received care when ill. Less than half of the children received clothing, recreation and transportation from the

households. Older persons occupied a receiving position between the children and primary earners. Over three-fourths of them obtained all recreation and transportation from the households while about one-third received clothing and care when ill.

Half of the children who lived outside the households obtained food from the interacting households while

one-fourth received money and clothing. Parents who interacted with rural non-farm and urban households received a variety of items including money, food, clothing, and care when ill. Parents interacting with rural farm households received less.

227 pages. \$2.84. MicA 55-160

JOURNALISM

**CHANGES IN NON-ADVERTISING CONTENT
OF TWO SELECTED GROUPS OF NEWSPAPERS
SUBSCRIBING TO TELETYPESETTER
CIRCUIT OPERATION**

(Publication No. 9569)

David R. Bowers, Ph.D.
State University of Iowa, 1954

Chairman: Professor Leslie G. Moeller

This study was designed to determine quantitatively possible changes in non-advertising content of five selected upstate New York and ten selected downstate Illinois daily newspapers after the newspapers replaced Associated Press single circuit afternoon Teletype operation with Associated Press single circuit afternoon Teletypesetter operation.

The investigation basically was a study of the introduction of a mechanical innovation in the daily newspaper processes and the possible effect upon the content of the newspapers using this device. The Teletypesetter circuit is a system which permits an operator at a central point indirectly to set news stories in type in a number of far-distant newspaper publishing plants.

The time periods selected were January 21 - March 29, 1952, and comparable January 19 - March 28, 1953, for the upstate New York newspapers and March 24 - May 31, 1952, and March 23 - May 30, 1953, for the Illinois newspapers. The first ten-week period preceded each Teletypesetter circuit initial operation date by two weeks. A sample selected from each state group consisted of sixty issues for each of the time periods. Issues were chosen by purposive selection to allow equal representation of all newspapers in their respective groups and to all days of the week. A set of categories were selected and defined for use in revealing changes in content. Measurement was by space count with the unit of measurement the column inch.

The research disclosed, among other things:

That there were no radical changes in content of the two newspaper groups studied following adoption of the Teletypesetter process.

That there were several possible trends, indicated by slight changes in content as revealed in this study. They were: (1) a slight tendency toward more general

news and feature material; (2) a slight tendency toward more wire news; (3) a slight tendency toward less local news; (4) a slight tendency toward less pictorial material, particularly photographs.

226 pages. \$2.83. MicA 55-161

**CAMPAIGN EXPENDITURES AND THEIR
CONTROL: A STUDY OF EXPENDITURES
FOR TELEVISION TIME IN THE 1952
FEDERAL ELECTION**

(Publication No. 10,519)

Irving Rodgers Merrill, Ph.D.
University of Illinois, 1954

The problem investigated was the general efficiency of Section 315 of the Federal Communications Act as Amended, which becomes operative for political broadcasts in only those cases where the legally qualified candidate appears in person on his own behalf. The first purpose was to determine to what extent spokesmen instead of candidates were used during the 1952 federal election campaigns. The second purpose was to test the hypothesis that the operation of current election laws regulating political campaigns forces much television political broadcasting outside the areas controlled by Section 315.

The analysis was based upon field data supplied the writer by the Subcommittee on Privileges and Elections of the Committee on Rules and Administration, United States Senate, which made a census-survey of all 110 U. S. television stations in regular operation during the 1952 federal election for the period August 1 through November 4. A "station census analysis" summarized for each station the expenditures for television time in political campaigning and then totalled the summaries of all stations. A "contested campaigns analysis" summarized the expenditures of individual candidates for the offices of 1) president, 2) senator, and 3) general federal slate urging voters to "vote Republican," etc. The contested campaigns analysis was limited to the sub-universe of contested campaigns in 18 states where television was available, which included expenditures in the presidential contest, 20 senatorial contests,

and 18 general contests. (Connecticut and Nebraska elected two senators each.)

The television station census analysis indicated that of the total expenditure of \$2,951,329, the Republicans accounted for 55%, Democrats 44%, and other parties 1%. Of the \$544,662 expended by all parties for spot announcements, 73% was devoted to the Eisenhower presidential campaign. Of the \$2,008,419 expended by all parties for programs, 43% was devoted to the Stevenson presidential campaign, 38% to the Eisenhower campaign. About 40% of the total program expenditure by each major party was devoted to broadcasts by spokesmen.

The contested television campaigns analysis indicated that where expenditures of all candidates per senate seat contest were totalled, the expenditure for each of 11 contests ranged around \$2,500, for each of 4 contests ranged around \$12,500, for each of 3 contests ranged around \$27,500, and for each of 2 contests ranged around \$37,500. The contested campaigns analysis also indicated that current election laws produced a greater percentage of broadcasts using spokesmen instead of candidates than could be attributed to the sheer amount of television campaigning alone.

Conclusions drawn from the analyses were 1) the hypothesis that the operation of current election laws forces much television political broadcasting outside the areas controlled by Section 315 was confirmed, 2) the amount of revenue from political advertising may soon be sufficient to justify specialization by the industry to serve this class of clients, 3) Section 315 proved inadequate during the 1952 television election campaigns.

Recommendations drawn from the conclusions were 1) the provisions of Section 315 should be revised to include authorized spokesmen, and 2) the Subcommittee on Privileges and Elections should complete an official report of the survey undertaken during the 1952 election.

101 pages. \$1.26. MicA 55-162

AN ANALYSIS OF METHODS FOR MEASURING NEWSPAPERS' COVERAGE OF PRESIDENTIAL ELECTION CAMPAIGNS

(Publication No. 10,128)

Granville Price, Ph.D.
University of Missouri, 1954

Criticism of newspapers' performance in the 1952 presidential election campaign pointed to the need of objective methods for reporting the differences among newspapers in the proportions of political direction in campaign news. This study compared the operation of a number of quantitative measures and assembled a battery of them that should give a valid picture of individual newspapers' performance in the context of group performance.

The term "differences" was used, in arraying newspapers' performance on continua between the

extremes of party favor, to avoid the subjective implications of the word "bias." Statistical comparison identified measures that appeared both stable and economical in four areas of news treatment: reporting or omission of significant news, display and content of headlines, display and content of news stories, and pictures.

An objective formula for weighting of political campaign news in proportion to display in standard format newspapers was created, based on the relationship of reader effects and manifest content. A basic pattern of a difference of percentages of elements favoring the two parties was found to agree with respected measures already in use and to provide comparable scores from the four areas of news treatment.

Four quantitative measures of newspapers' treatment of campaign news would – in a large scale study – summarize much of what can be told objectively about comparative performance. The difference of percentages of significant events exposes extreme omissions favorable to one side. Headline treatment can be described by a relatively simple difference of percentages of display indexes, or by a more tedious counting of statements that will be closely parallel. It appears unnecessary to report measures of both content and display of headlines. News story content can be described by a difference of percentages of column inches, or by a more tedious counting of statements with closely parallel results. If inches are the unit, it may be desirable to check statements of stories that are coded "neutral" for deviations from the partisan pattern. If statements are counted, the "favorable" and "unfavorable" totals of statements for the two parties will contain information about both the campaign and the newspapers' treatment of it that cruder measures will not show. For pictures, a simple difference of percentages of area appears as accurate as a weighted measure.

A composite score for a newspaper combining scores from the four areas was rejected as unsound. Instead, it was proposed that arrays of newspaper scores for each area be converted to Z scores which emphasize individual newspapers' relation to the means of the area arrays and thus avoid the assumption that equal treatment of opposing sides is necessarily the ideal. On such arrays the reader can set his own limits of "fairness."

244 pages. \$3.05. MicA 55-163

A STUDY OF PROSPECTIVE
HIGH SCHOOL TEACHERS' ATTITUDES
TOWARD DAILY NEWSPAPERS AND
FREEDOM OF INFORMATION

(Publication No. 10,129)

James Lloyd Rogers, Jr., Ph.D.
University of Missouri, 1954

The purpose of this study was to determine the attitudes of prospective high school teachers toward American daily newspapers and toward freedom of information; to determine certain variables with which differences in such attitudes might be associated; and to reveal the extent of the prospective teachers' college training experiences with newspapers and the use of newspapers in the teaching program. Little attention had previously been paid to this problem.

The procedure in gathering data was as follows: (1) Three unidimensional scales were constructed by the Cornell technique for scale analysis - attitude toward daily newspapers, attitude toward freedom of information, and information about daily newspapers. (2) The population studied was secondary education students in seven state-supported teacher-training institutions in Texas. The sample from each college was determined by the proportion of its students who had been issued secondary teaching certificates in the preceding year. The 686 students in the sample were given the three scales and asked to supply additional personal information. (3) The attitude scores thus obtained were submitted to intensity analysis to gain a picture of the structure of the attitudes. (4) The personal data were tabulated. (5) Scale scores were submitted to analysis of variance in a study of the correlates of attitude.

From this study, the following conclusions may be drawn. A greater percentage of responses favorable to newspapers was revealed in answers to highly abstract statements. It appears that the prospective teachers would show greater approval of the general value of daily newspapers than of the job they are doing in certain areas. Approximately half of the students under study can be said to have attitudes

favorable to newspapers, the other half unfavorable. The attitudes of those occupying the middle third of the continuum could, however, be influenced to change in either direction. The population can also be said to be about evenly divided on attitude toward freedom of information, although these attitudes showed even less stability, with about 40 per cent of the sample failing to show real conviction in their beliefs. Approximately four-fifths of the respondents reported no college training experiences with newspapers or with how the teacher can utilize the newspaper.

The study found no evidence for belief that attitude toward newspapers changes as one progresses through college, that it differs among prospective teachers of different subject areas, or that those who possess greater information about newspapers show any more favorable or less favorable attitude than those with less information. The prospective teachers have been shown to vary in attitude toward freedom of information on the basis of the subjects they have been trained to teach. Those who plan to teach in the traditional areas possess more favorable attitudes than those trained to teach vocational subjects or physical education.

Political preference was found to be associated with both attitudes studied. In both cases Republicans showed more favorable attitudes and Democrats less. Independents were less favorable than Republicans toward newspapers, more favorable than Democrats toward freedom of information. The type of college training (excepting journalism) did not appear to be associated with an individual's knowledge of newspapers. Respondents' attitudes toward newspapers showed virtually no correlation with attitude toward freedom of information.

The techniques utilized in this study would seem to be worthy of investigation by newspapers in the study of reader attitudes and might also prove useful to those who place advertising in the mass media. Since the population in this study was confined to one group in one state, further investigations of the structure and correlates of attitudes toward newspapers and press freedom seem justified.

193 pages. \$2.41. MicA 55-164

LANGUAGE AND LITERATURE

LANGUAGE AND LITERATURE, CLASSICAL

PUDOR AS A CRITERION IN LATIN LITERATURE

(Publication No. 10,551)

Roy Arthur Swanson, Ph.D.
University of Illinois, 1954

The word pudor in contexts of literary criticism indicated a standard of moral propriety which imposed restraint upon vocabulary and subject matter. Pudor differs from stylistic criteria in that it governed what was written rather than how a work was composed. Thus, a composition caste pudiceque ornatu(s) (Gell. 6.14.11) is one showing stylistic conservatism, while versiculi classed as parum pudici (Cat. 16) are morally impure.

One violation of pudor is obscenitas. This is made evident in Ovid T. 2.409-410: Est et in obscenos deflexa tragoedia risus, / Multaque praeteriti verba pudoris habet. Quintilian speaks of obscena nudis nominibus enunti (ata) and testifies to his own restraint: ego Romani pudoris more contentus . . . verecundiam silentio vindicabo. Passages in Cicero (e.g., Flacc. 15.34, De Or. 2.59.242) and Quintilian (6.3.29, 8.2.2) state explicitly that obscenitas was to be avoided in formal expression. The central meaning of the adjective from which 'obscenitas' is derived was not funestus (ill-omened) but turpis. Cf. Varro (L.L.7.97): <ob>-scaenum omen est omen turpe. Obscena omina were originally verbal interpretations of repulsive (turpia) and/or unnatural (deformia) phenomena. Eventually 'omina' denoted the phenomena themselves, e.g., volucres: these were obscenae because of their turpitude or deformitas, not their ominousness; hence Varro's definition. Obscenus and turpis shared a dual direction in indicating the repulsive (foedus, deformis) and/or the shameful (impudicus). Obscenitas in literature was the use of nuda nomina (cf. Ov. T. 2.408) in non-clinical reference to the private parts, which were objects of shame, and their procreative, erotic, and excretory functions, as well as words or phrases suggestive of these (Cic. Off. 1.35.126-127).

A second moral fault, effeminatio, violated pudor through lack of restraint in the presentation of subject matter which a Roman considered effeminatus or unmanly. Virtus, the sum of the excellences of man (vir), comprised particular virtutes, including pudor and gravitas, each of which was opposed to voluptas (sensual pleasure); this was enervating (effeminanda) and productive of softness (mollitia). Amor, as "romantic love," was effeminatus since its basis was sensual pleasure. To idealize voluptas amatoria in literature was to produce composition considered effeminatus and, consequently, parum

pudicus. This is made clear in Catullus 16, where voluptas amatoria (here, basia) is defended. Catullus' stand for effeminatio in literature was misinterpreted by Pliny (Ep. 4.14) as a defense of a principle (lex) sanctioning obscenitas in light verse. Catullus used obscenitas, but his extant work includes no defense of its literary propriety.

The elegists followed Catullus in effeminatio. Public acceptance of elegy, a predominantly erotic literary mode, and the praise accorded it by Quintilian (10.1.93) prove that effeminatio, despite its being impudica, was sanctioned in Latin literature. The presumptuous defense of obscenitas by Auctor (es) Priapeorum (9, 49) and Martial (1.35), their admission that it must enjoy a limited public, and Apuleius' defense of his amatory verse (Apol. 9.1) against the imputation of obscenitas all prove its continued subjection to social disapprobation.

As a criterion in Latin literature, pudor required avoidance of two kinds of indecency, obscenitas and effeminatio, which should be distinguished from and not identified with one another.

95 pages. \$1.19. MicA 55-165

LANGUAGE AND LITERATURE, LINGUISTICS

THE VERBAL CATEGORIES OF SUBSTANDARD SPANISH

(Publication No. 10,512)

James Gerald Markley, Ph.D.
University of Illinois, 1954

The study is divided into two parts: Part One is the text, a phonemic transcription of eight tapes of recorded interviews with speakers of substandard Mexican Spanish; Part Two is an application of the methods of structural linguistics to an analysis of the verbal categories of the language of that text. The four verbal archcategories constitute the linguistic expression of the relationship between the action and four other elements of the utterance: tense (1), the relationship to the non-required modifier (the temporal adverb); mood (2), to another action; voice (3), to the required modifier (the predicative or object one); and agreement (4), to the actor. The categories are established on the basis of contrasting linguistic meanings. The results of this study of substandard Spanish not only are applicable to any form of Spanish, but they also constitute a generally valid approach to the study of verbal

categories, at least of the Indo-European languages. The following table summarizes the results of the investigation:

1. Tense		
1.1. Contingency		
1.11. Relative tenses		1.12. Absolute tenses
		<u>cantó</u>
1.111. Timebase non-past	1.112. Timebase past	
<u>dicen que cantan</u>	<u>dijeron que cantaban</u>	
1.2. Aspect		
1.21. Perfectivity	1.22. Imperfectivity	1.23. Punctuality
<u>ha cantado</u>	<u>cantaba</u>	<u>cantó</u>
2. Mood		
2.1. Coordination		2.2. Subordination
2.11. Statement		2.21. Statement
<u>me voy porque canta</u>		<u>es que canta</u>
2.12. Imperative		2.22. Imperative
<u>tocaré para que cantes</u>		<u>quiero que cantes</u>
2.13. Question		2.23. Question
<u>te pagaré lo que sea</u>		<u>no creo que cante</u>
2.14. Tense (contingency-aspect)		2.24. Tense (aspect)
<u>cantada la canción, se fué</u>		<u>siguió cantando</u>
3. Voice		
3.1. Two-voice (or	3.2. One-voice (or	3.3. No-voice (or
transitive) verbs	intransitive) verbs	copulative) verbs
	<u>fué al pueblo</u>	<u>es un buen niño</u>
3.11. Active		
<u>cantan la canción</u>		
3.12. Passive		
<u>se canta la canción</u>		
4. Agreement		
4.1. Person	4.3. Number	4.5. Case
<u>canta : canto</u>	<u>canta : cantan</u>	<u>canta, niño! : el niño canta</u>
4.2. Relation	4.4. Gender	4.6. Presence of actor
<u>canta, niño! :</u>	<u>enojado, se fué :</u>	<u>el niño canta : llueve</u>
<u>cante, señor!</u>	<u>enajada, se fué</u>	

348 pages. \$4.35. MicA 55-166

AN ETYMOLOGICAL VOCABULARY OF THE SPANISH IN THE WORKS OF GIL VICENTE

(Publication No. 9729)

William Whatley Moseley, Ph.D.
University of New Mexico, 1954

The primary purpose of this dissertation is to provide for the use of the student of Gil Vicente a complete Spanish-English vocabulary, with etyma, embracing the drama and lesser works of Gil Vicente. The main body of the dissertation is preceded by an introduction which calls attention to those aspects of his Spanish which demonstrate possible Portuguese influence.

About half the total number of verses composed by Vicente were written in Spanish. It is only natural that many traces of his native Portuguese should appear in his writings in Spanish; this fact only adds to the difficulties normally encountered in reading Spanish texts of the sixteenth century. A need, therefore, was felt for the vocabulary which comprises the major portion of this dissertation.

The vocabulary contains some five thousand entries. The etymon of each word, where known, is included in parentheses following the main entry; where possible an authority is given for the etymon

cited. An abbreviation indicating the function of the word is included following the etymon. Meanings are given in English; passages illustrating the use of the word in context are quoted to clarify or substantiate the meaning given. In order to preserve the linguistic usefulness of the work, both the entry words and the passages cited are recorded exactly as they appear in the princeps edition of 1562. For convenience, locations of quotations are given for both the edition of 1562 and for the modern Marqués Braga edition of Vicente's complete works. Locutions and variants, with cross-references, are also included.

The vocabulary is preceded by an introductory study in which an attempt is made to classify and analyze the real and apparent Portugueseisms found in the Spanish of Gil Vicente. Many characteristics which may be the influence of Vicente's native tongue can also be explained as the result of other influences; the problem is further complicated by the extent, largely undetermined, to which the editors and printers of the edition of 1562 introduced errors into the text. The influence of Portuguese is naturally the most powerful; in addition, there are indications that some non-Spanish elements may be attributed to Vicente's early study of works written in the Leonese dialect of Spanish and to his reading of archaic Spanish. One can also detect certain

Portuguese elements which were deliberately introduced by the poet, generally for purposes of meter or rhyme. Characteristics of Vicente's Spanish which are common to Portuguese and to Leonese or archaic Spanish, or to all three, are pointed out. The true Portugueseisms, those elements which can be explained solely as the influence of Portuguese, are then presented and are further divided into several categories.

The introduction also contains a brief critical sketch of the various editions of Gil Vicente's works and some considerations on Vicente's possible motives in employing Spanish for such a large portion of his literary production.

735 pages. \$9.19. MicA 55-167

A STRUCTURAL ANALYSIS OF THE EPIC STYLE IN THE CID

(Publication No. 10,563)

Louise Hatch Wester, Ph.D.
University of Illinois, 1954

The study is an experiment in literary analysis. It attempts to transfer to the study of literature some of the methods of structural linguistics, and thereby to establish a method for describing literary works as linguists describe languages. The study represents a hesitant first step in the direction of establishing such a method. It takes as the example to be described by the method the Old Spanish epic, the Cantar de mio Cid.

The analysis is on three levels: taxemic, morphemic, and phonemic. A different method is used on each level: Discourse Analysis (adapted from Zellig S. Harris) on the level of the literary taxeme, Information Analysis (adapted from communication theory and semantic studies) on the level of the literary morpheme, and Sound-figure Analysis (adapted from Schallanalyse and the phonemic studies of Roman Jakobson) on the level of the literary phoneme. The study concentrates on certain aspects of the work which seem characteristic of it, rather than attempting to account for every phenomenon of the text. Thus, in dealing with the literary taxeme, the study seeks to establish the basic sentence patterns of the text (but not to describe details of the syntax.) Similarly, in dealing with the literary morpheme, the study concerns itself with the influence of some morphemes on others, conditioning the amount of information conveyed in a given passage (but does not describe every morpheme or allomorph of the text.) Also, in dealing with the literary phoneme, the study concentrates its attention on those phonemes which are influenced by the sound patterns of the work (but does not describe every sound feature of the text.)

The study regards literary meaning as implicated in literary structure on all levels, and therefore regards the literary taxeme, morpheme, and phoneme as form-meaning units. The analysis makes possible the establishment of two archetypal patterns characteristic of the Cid on each of the three form-meaning levels, as follows:

(a) On the level of the literary taxeme: the actor-action pattern, expressing foreground material, or feudal culture; and the adverb-action pattern, expressing background material, or the Spain of the Cid's day.

(b) On the level of the literary morpheme: the chronicle style, showing a high density of informative literary morphemes and little redundancy; and the poetic style, showing a low density of informative literary morphemes and high redundancy.

(c) On the level of the literary phoneme: the suprasegmental literary phoneme, the six-beat rhythm of the line with strong pre-caesura position; and the segmental literary phoneme, the assonantal rhyme with high resonance as a distinctive feature.

308 pages. \$3.85. MicA 55-168

LANGUAGE AND LITERATURE, MODERN

COLERIDGE'S REVISIONS OF THE FRIEND: A STUDY OF HIS THOUGHT AND METHOD

(Publication No. 10,445)

June Dudley Bailey, Ph.D.
University of Illinois, 1954

This study was immediately motivated by the discovery that Griggs's study of the revisions is inaccurate. It was encouraged by the general vagueness about the so-called middle years of Coleridge's intellectual history, by the comparative silence about The Friend in criticism of Coleridge, and by the enlarging discovery that criticism of Coleridge continues a long tradition of slighting his works and emphasizing biographical sources in dealing with him.

Prevailing opinions both underestimate and overestimate the extent of the revisions. Those made in 1812 are more extensive than Griggs suggests and less so than Wise would lead us to believe. And the generally held view that the 1818 edition approximated a new work – a view which Coleridge's prefatory remarks to that edition encourage – needs considerable modification. The first two volumes retain almost entirely materials from the 1809 version; and over a third of the remaining volume is gathered from the first edition. And for the most part, the materials were retained in the order they held in 1809.

The major omissions from the 1809 text in 1818 are irrelevant poetry and prose of Wordsworth and Coleridge, business notices and passages pertinent only to periodical publication, the original Prospectus and repetitions of parts of it, passages of self-defense, problems Coleridge omitted from his later scheme (especially, for literary students, those dealing with literature and the fine arts), and a few passages dealing with Coleridge's scientific or philosophical views. These last ones are of importance

in that they demonstrate that Coleridge had definitely freed himself from the "lingering Hartleyanism" which Griggs had found in the 1809 edition.

The major additions are introductory and transitional passages required to give continuity to the broken up and sometimes re-ordered essays, elucidations of points in the 1809 text, and the bulk of the second section on morals and religion. Only this last and one of the other additions may properly be said to extend the 1809 text; and both are in keeping with the original Prospectus and are anticipated in Coleridge's thought in or before 1809.

Minor revisions are confined to grammatical and rhetorical problems which the long, involved sentences and the sloppy printing of the first edition, along with Coleridge's desire for clarity or phrase and precision of diction, made for. And his reworking of materials shows, as do all the revisions he made, that Coleridge was motivated by a desire to clarify and simplify his prose, to sharpen the focus of his point of view, and with these, to make more incisive his criticism of the popular political and moral opinions of his day. In short, the study argues both that Coleridge's thought was consistent from at least 1809 to 1818 and that he was a rather more careful workman in prose than he is generally considered. And it points to a number of corrections which a careful scrutiny of his published works may provide for the more general criticism of Coleridge.

242 pages. \$3.03. MicA 55-169

**PIO BAROJA: HIS
CONTRADICTORY PHILOSOPHY**

(Publication No. 10,452)

Walter Borenstein, Ph.D.
University of Illinois, 1954

It was the purpose of this thesis to demonstrate the contradictory philosophy of life of the Basque writer Pio Baroja through an analysis of his literary works. Baroja's critics were shown to represent only segmental approaches, in that each of them isolated but a fraction of his intricate and opinionated philosophy. No segmental approach could explicate the inconsistency, the paradox and the contradiction which are intrinsic to Baroja's ideas. In this thesis, several of the author's concepts were considered in order that the relationships between them might be established, and their extreme inconsistencies might be presented as evidence that no philosophy exists in Baroja's contradictory schema.

Baroja's writings in the period of 1893 to 1923 were chosen as research material. The earliest period, from 1893 to 1900, included only articles and essays from the periodicals on which the author collaborated during these years. The first literary period extended from the publication of his first volume in 1900 to the outbreak of war in 1914. The second period continued until the military dictatorship of Primo de Rivera in 1923. Almost all of the work of

these years was considered with the exception of the *Memorias de un hombre de accion*. The repetitive nature of Baroja's philosophy, as depicted in his prolific writings, made it clear that further reading would lead only to an interpretation of new historical events within his same frame of reference.

The method employed in this thesis consisted of a primary determination of the philosophy of the author as expressed in his essays and in those sections of his novels wherein he speaks as Baroja himself. The resulting ideology was formulated to be Baroja's self-concept. The characters of his novels were then analyzed and their development was considered to be an indication of the real self of the author, - the personality that lay dormant beneath the blustering, indifferent and expedient attitude of Baroja and which found expression only in his literary creation.

The study of Baroja's self-concept suggested his attempt to fulfill both an idealization of the man of action he had created in his writing, and his determination to convince mankind that he was in reality the cruel, selfish, vain, callous and indifferent cynic whom society had envisioned. Numerous heroes of his novels, who represent some facet of the Machiavellian man of action, are endowed by the author with this self concept. However, he has simultaneously bestowed upon them the compassion and the humanitarianism, the sensitivity and the nostalgic sentimentality that are so integrally a part of his real self. Precisely this conflict, between two irreconcilable characterizations, leads to either the failure or the destruction of Baroja's heroes in their attempts to articulate their philosophy of action in the harsh milieu of modern society.

Baroja conceives of the universe as a jungle, without moral purpose and utterly disassociated from the struggle for life which rages in its sphere. As the physical world is amoral, so must man become an individual without respect for ethics or order. The major part of the author's literary creations represents the contradiction within his own personality. Compassion can not coincide with cruelty, nor humane feeling with indifference. The conclusion is total pessimism. The successful man of action can not grasp the tragedy of humanity and is intent on self gratification. The sensitive and humane man fails because he can not follow the amoral road to success. Only the theoretical superman can carry out the amoral program of action. There is no hope for mankind and man is doomed to wander alone through a maze which he will never understand.

425 pages. \$5.31. MicA 55-170

THE IRISH WRITINGS OF JONATHAN SWIFT

(Publication No. 10,471)

Oliver Watkins Ferguson, Ph.D.
University of Illinois, 1954

This study aims at a more detailed examination than any yet made of a significant phase of Swift's

literary career. Its scope is large; for, with the exception of the verse and some of the trifles of his last years, all of Swift's writings after 1720 — as well as a few pieces between 1707 and 1710 — deal either directly or obliquely with affairs in Ireland.

Swift was moved to intervene in Irish affairs in 1720 by political and economic events of the preceding year, and his first published tract on Ireland, *The Proposal for the Universal Use of Irish Manufacture*, is retaliatory, attacking England for her tyrannical Irish policy. *The Drapier's Letters* (1724-25) are in the same vein and urge the same kind of resistance as did the 1720 *Proposal*: boycott. After 1725, however, Swift came to realize that Ireland's political dependency was but one reason for her moribund state and that a sound domestic program for improving her manufactures and agriculture was as important as the vindication of her political rights. Accordingly, he began to emphasize domestic issues, advancing plans for virtually every phase of Ireland's economy. This new attitude is responsible for a major theme of Swift's Irish writings: his insistence that Ireland as well as England shared the responsibility for Ireland's plight. The retaliatory tracts of 1720 and 1724-25 were written chiefly to point up England's share of guilt; the prescriptive tracts from 1725 to 1729 were predominantly concerned with awakening Ireland to her responsibility.

But both England and Ireland failed to respond to Swift's charges and exhortations; England continued her policy of exploitation, and Ireland remained in her state of moral and physical torpor, neglecting agriculture for grazing and preferring foreign to domestic articles of manufacture. Consequently, Swift abandoned the struggle, but as a Parthian shot he wrote *A Modest Proposal* and the *Answer to the Craftsman* — the first directed chiefly to Ireland, the second to England. These tracts are his indictment of both countries, whose common crime was the murder of a nation.

There is no real break between what may be called Swift's English and Irish periods; the writings of both are based on consistent principles of human conduct that Swift held throughout his life. He first asserted them in *A Tale of a Tub*; he acted upon them when he broke with the Whigs in 1710; he maintained them throughout the Tory debacle of 1714 and in the face of personal misfortune on his return to Ireland in that year; and he gave his most compelling expression of them in *Gulliver's Travels*. The 1720 *Proposal* was in effect another approach to the object he had sought since the downfall of the Tory ministry. From defending their political principles — in the "histories" of Anne's reign — he turned to an attack on their enemies, the now triumphant Whigs. Ireland became not merely a convenient means for him to attack the Whigs; it was an inevitable one, for he attributed many of Ireland's ills to Whig policy. The Dependency Act of 1719 supported his view, and Wood's Patent confirmed it.

The great mission of Swift's life was to awaken men to a sense of moral and intellectual responsibility. *A Tale of a Tub*, the tracts in support of the Tory ministry, the Irish writings, and *Gulliver* are all

expressions of this mission, and each is related to the others as a part of this larger design. This explains Swift's attitude toward the Irish, for as a moral reformer he could not sanction their continued lethargy and folly. Making all allowances for the deadening influence of centuries of oppression, he still put much of the responsibility for their condition on the Irish themselves. They could not help the legislative restrictions England had imposed upon them, but they could do something to better conditions within their country. Except for their resistance to Wood's Halfpence, however, they had failed to meet their responsibility. Hence, after nine years of trying to help the people help themselves, Swift virtually ceased in his efforts. *A Modest Proposal* is the moral reformer's final judgment on the people of Ireland.

236 pages. \$2.95. MicA 55-171

THE EARLY LIFE OF LAFCADIO HEARN

(Publication No. 9071)

Orcutt William Frost, Jr., Ph.D.
University of Illinois, 1954

Although I owe much to previous Hearn biographers, I have not wished to present a simple reinterpretation of their work. In an attempt to fill in gaps in the record of Hearn's obscure early years, I have followed his trail through Europe, examined original sources, interviewed his relatives, and consulted many authorities. I have thereby had opportunities which my predecessors in this work have not had; for none of them have journeyed in Greece and France as well as in England and Eire in quest of biographical data on Lafcadio Hearn.

Furthermore, I have ventured to lay bare the full story of Hearn's journalistic career in Cincinnati; and in a concluding chapter I have briefly reviewed his literary work down to 1890, the year of his departure for Japan, in order that the dissertation might be a fairly complete unit, including not only the period of literary apprenticeship, but also the American years of literary fruition.

I have not opened to view a new and intimate Lafcadio Hearn. I have used the usual sources, the letters written by Hearn to his friends, the autobiographical sections in his books and in his newspaper writings, and the results of inquiries made by two biographers, Elizabeth Bisland Wetmore and Nina Kennard. My role has been supplementary and, to a great extent, corrective. Authorities which I introduce are chiefly official documents, unpublished letters, and uncollected newspaper articles.

422 pages. \$5.28. MicA 55-172

PASSION AND THE TRADITION: A CRITICAL
APPRAISAL OF FORD MADOX FORD

(Publication No. 10,582)

Elliott Bickley Gose, Jr., Ph.D.
Cornell University, 1954

The best novels of Ford Madox Ford not only stand by themselves as works of art; they also reflect the experience of their author. The aim of this study is to work from an evaluation of six of those novels toward some understanding of Ford himself.

The first chapter deals with the collaboration of Ford and Joseph Conrad. The novel picked for analysis is *The Inheritors* (1901). The second chapter is concerned with Ford's novel, *The Benefactor* (1905), which contains a conflict similar to that of *The Inheritors*. In both (as, indeed, in all of Ford's important novels) the protagonist has to choose between one action which will give him the woman he loves and another which will mean sacrificing her for the sake of a tradition in which he believes.

The two novels studied in chapter three add another woman to the conflict previously sketched. In both *A Call* (1910) and *The New Humpty-Dumpty* (1912) the protagonist must choose between the woman to whom his sense of honor links him and the one toward whom his passion pulls him.

Essentially the same pattern is present in both *The Good Soldier* (1915) and *Parade's End* (1924-1928), the novels dealt with in the fourth and fifth chapters. Even more than the earlier novels, however, these two masterpieces resist reduction to a simple pattern. In fact, as the last chapter of summary and conclusion tries to point out, the only constant factor which the six novels share is the conflict between passion and tradition. Its form and resolution vary even more from one novel to the next than did Ford's solutions to the conflicts in his own life. And yet there is an important connection between the two, an artistic transformation of his personal relations into his fiction.

Ford married in 1894 and separated from his wife in 1908. During the next three decades he lived with three different women. Although he never took lightly this changing of partners, the fact that passion invariably triumphed in his own life might seem to minimize the conflict in his novels. For in theory as well as practice Ford stood on the side of the individual. He derived his philosophy from the Provence of the Middle Ages (which he claimed to have received as a tradition from his father and his grandfather). The tenets of Ford's philosophy, and that of the troubadours as he saw it, were tolerance in conduct and religion, a zest for life and the arts, and the code of chivalry. While Ford's own conduct always needed the sanction of tolerance, he had a strong sense of the ideal. In his youth, he found a code in his Pre-Raphaelite background, but as he grew older, he was drawn toward the ideal of the Tory gentleman, whom Ford saw as the modern incarnation of the feudal landlord, as he himself was of the chivalric troubador.

Thus we find in Ford's greatest character,

Christopher Tietjens of *Parade's End*, someone who goes through experiences and achieves an unswerving felicity quite similar to Ford's own after the First World War. The conflict in the novel comes from Tietjens' being the younger son of a landed Tory family which cannot condone adultery. This part of Tietjens' background was projected from Arthur Marwood, a friend whom Ford called the last Tory and whom he admired immensely. Marwood was a model also for Ford's own idea of himself as a gentleman in the grand tradition.

This pretention on Ford's part, combined with his penchant for telling anecdotes about incidents which had often never occurred in actuality, served to alienate him from many literal-minded people. But even in such imperfections of character, Ford's true nature appears. He described himself as an Impressionist, one who tries artfully to render, not the facts, but the essence of life. Taking this dictum seriously in living brought him some notoriety during his lifetime. Having practiced it seriously, as he attempted to render life in his novels, should win him a measure of fame now that he is dead.

314 pages. \$3.93. MicA 55-173

THE ART OF HISTORY IN
RENAISSANCE ENGLAND: A CHAPTER IN THE
HISTORY OF LITERARY CRITICISM

(Publication No. 10,587)

Owen Jenkins, Ph.D.
Cornell University, 1954

The art of historical narrative has generally been neglected in modern critical discussions, and students of the history of literary criticism and of historiography have read back into the past the radical separation usually made in contemporary thought between history and the poetic arts. Such a procedure has resulted in a lack of depth and range in contemporary poetic criticism and discussions of history, and serious distortions and misunderstanding of the literary criticism and historical writing of other epochs.

The value and necessity of the consideration of the artistic aspects of historical writing is illustrated in this study of critical discussions of history in Renaissance England. Neglect of the prefaces, essays, and treatises on historical writing has resulted in a misleading emphasis in the reconstruction of literary criticism in the period from 1500 to 1650 and also in an incomplete understanding of poetic theory from Sir Thomas Elyot to the early neo-classical critics. Poetry was habitually defined and discussed in terms of its relationships to history and philosophy, and the meaning and practice of all three changed drastically around the turn of the seventeenth century.

For most of the sixteenth century the highest forms of both poetry and history were thought to provide examples of the precepts of philosophy, and

for most purposes of critical discussion it was not necessary to distinguish between them. Sir Philip Sidney introduced a new tendency in criticism when, in the *Defence of Poesie*, he emphasized the differences, not the similarities, between history and poetry. Both Sidney and Francis Bacon in *The Advancement of Learning* conceived of poetry as ideally figuring forth the precepts of philosophy, but in *De Augmentis Scientiarum* Bacon reduced most kinds of poetry to mere fanciful exercises of the wit. History alone played an important role in Bacon's plans for a revolution in philosophy, and history was now restricted to "the particular truth of things" and separated from the general precepts of conventional ethical and political philosophy.

The better seventeenth century historians took much the same position. History, it was now argued, was a narrative of particular facts, and the facts were no longer to be accepted as true simply because they provided *exempla* of the precepts of conventional morality or were supported by the force of tradition. The historians accordingly worked out many of the principles of modern historical methodology in theory and applied them in practice. They also set forth a theory of historical truth and historical imagination which for the first time adequately differentiated history from poetry in English critical theory.

New philosophical tendencies and their professed devotion to the truth caused the historians to place less emphasis on the moral value of history, but they did not repudiate the Humanist idea that history was essentially a form of vicarious pragmatism which enabled men to profit from the experience of others. Writers in the popular tradition of works on the proper method of reading history continued to emphasize the practical value of history, and Thomas Hobbes argued that its nature if "merely narrative," and the narrative "doth secretly instruct."

Hobbes brought together the three main elements in later Renaissance historical criticism: the emphasis on the value of reading history for instruction in the art of practical wisdom derived from Humanist educational theories, the emphasis on a well-constructed narrative derived from the practice of classical historians, and the emphasis on truth of particular facts derived from the efforts of English historians and antiquarians to "reinstat[e] truth in our histories, from which it had been banished either by the confidence of writers or the credulity of the vulgar."

293 pages. \$3.66. MicA 55-174

LEOPOLDO ALAS AND NATURALISM IN THE SPANISH NOVEL, 1881-1892

(Publication No. 9728)

Charles William Matlack, Ph.D.
University of New Mexico, 1954

The Problem

No thorough study has been made of naturalism in the Spanish novel during the period of Émile Zola's greatest popularity. Scholarly opinions have varied widely in regard to the nature and extent of Spanish naturalism. The problem, therefore, was to define Spanish naturalism in four essential ways: the influence of Zola, the naturalistic rating of the individual authors, the difference between naturalism and realism, and the significance of Spanish naturalism as a literary movement.

The Procedure

Leopoldo Alas ("Clarín") was chosen as the central figure because of his important dual role as a critic of contemporary literature and as a novelist influenced by naturalism.

In Chapter I, "The Criticism of French Naturalism," an analysis is made of the opinions of Alas and Emilia Pardo Bazán, who favored the new movement, and Marcelino Menéndez y Pelayo and Juan Valera, who opposed it.

Chapter II, "The Theory of Spanish Naturalism," traces Alas's changing views of the character and importance of Spanish naturalism with frequent side glances toward the judgments of Pardo Bazán, Menéndez y Pelayo, Valera, José María de Pereda, and Benito Pérez Galdós.

Chapter III, "Naturalistic Novels of Alas's Contemporaries, 1881-1892," and Chapter IV, "Alas's Short Stories and Novels," deal with the characteristics of Spanish naturalism as revealed in *La desheredada* and *Lo prohibido* of Galdós, *La Tribuna*, *Los pazos de Ulloa*, *La madre naturaleza*, *Insolación*, and *Morriña* of Pardo Bazán, *Pedro Sánchez* and *La Montálvez* of Pereda, *La espuma* and *La fe* of Palacio Valdés, and a number of Alas's short stories plus his two novels, *La Regenta* and *Su único hijo*. The principal characteristics were found to be the somewhat limited acceptance of Zola's deterministic theories, resulting in an emphasis on the influence of environment, circumstances, and temperament and the concept of collective as well as individual ethical responsibility; the serious depiction of widespread moral corruption in contemporary society - lust, greed, and especially adultery; an abundance of abnormal characters; detailed descriptions and objective technique; and the avoidance of well knit plots. Other features common to most but not all of the works in question were integralism, that is, acceptance of both the ugly and the beautiful, the low and the noble; a satirico-moral type of humor; substitution of a group for the individual protagonist; and use of the stream of consciousness method of character portrayal.

In the final chapter, "Synthesis," the findings of the investigation are summarized under four headings: first, the influence of Zola – strong, but with no outright imitation; second, the rating of the Spanish naturalists – Alas, Galdós, and Palacio Valdés the most naturalistic; third, naturalism and realism – the former a species of the realistic genus; fourth, a definition of Spanish naturalism – a combination of Zolaesque and indigenous Spanish elements resulting in an expansion of traditional realism affecting the novelist's choice of themes, goals, and techniques.

177 pages. \$2.21. MicA 55-175

POE'S LITERARY BATTLES

(Publication No. 10,524)

Sidney Phil Moss, Ph.D.
University of Illinois, 1954

One of the few gaps in Poe scholarship, which this study attempted to fill, was a treatment of Poe's literary battles. From 1835 to 1849 – a period that spans Poe's whole periodical career – Poe was engaged in critical controversies. These controversies had, by and large, a singleness of purpose which has hitherto been neither revealed nor investigated – a fact that has led to a great deal of error and misconception concerning Poe's critical career.

This study of Poe's literary battles revealed that for the most part they were neither sporadic nor spiteful attacks, as has been generally believed, but unified campaigns in a war against the coteries and editors that were dominating American letters, and that could make the reputations and fortunes of those authors and publishers with whom they were in league, and that could ruin those who were outside the pale or who threatened their interests. Beginning in 1835 with his criticism of Norman Leslie, the novel by Theodore S. Fay, Poe aggressively assumed the role of literary reformer and single-handedly engaged the most powerful clique then operating in America – the New York group. This engagement lasted his entire critical career, and his courage and high-mindedness are amply attested by the fact that he persisted in his assault despite the grave danger of ruin – a ruin to which he was finally brought. Poe's struggle against the coteries led him to develop critical practices that, for the America of that period, were unprecedented and brilliant, and that earned for him ultimately the distinction of being our first great critic. The coteries, for their part, striving to maintain themselves against Poe's excoriating attacks, continually attempted to damage Poe's reputation and thereby to discredit his critical judgments – attempts that Poe inadvertently abetted by the kind of life he led, or, more charitably, was forced to lead.

What was also revealed is that Rufus Wilmot Griswold – the man who, as Poe's literary executor, did most to establish Poe's notorious posthumous reputation – did not malign Poe or forge some of his letters for purely personal reasons, as has been

invariably believed. His malice was in great part inspired by the enmity of the New York clique to Poe. Griswold was extremely sympathetic to the members of that clique, especially to Lewis Gaylord Clark about whom that clique gravitated.

It is impossible to comprehend, appraise, or appreciate Poe's critical work unless one clearly understands that he was a literary reformer, a lone figure who waged uncompromising war against the evils that were besetting American letters and that today have become full blown. The recreation of the literary period in which Poe worked, the forces with which he contended, and the issues to which he had dedicated himself show Poe's literary quarrels to have been a unified action that made his critical career coherent and significant. More, they reveal Poe, not only as a man of his age, but as a critic whose literary principles and fearless militancy earned him an enmity that had much to do with shaping his contemporary and posthumous reputation.

227 pages. \$2.84. MicA 55-176

LA RENOMMÉE LITTÉRAIRE DE MARCELINE DESBORDES-VALMORE (1820-1950)

(Publication No. 10,528)

Elaine Francine Charlotte Newkirk, Ph.D.
University of Illinois, 1954

Née en 1786 et morte en 1859 Marceline Desbordes-Valmore est une poétesse qui a été réhabilitée à la fin du siècle dernier et dont la renommée depuis n'a fait que croître. Cette réhabilitation, en dépit de sa soudaineté apparente, avait été préparée par une longue période de germination. Dès 1820, contre-coup direct du succès des *Méditations* de Lamartine, la deuxième édition des *Poésies* de Marceline avait fait du bruit. On découvrit dans les idylles élégies et romances de la nouvelle poétesse un certain talent pour la poésie pastorale. On ne vit pas qu'un peu avant Lamartine (la première édition était de 1818) Desbordes-Valmore avait annoncé le romantisme élégiaque et sentimental et introduit dans un cadre et un vocabulaire encore classiques un lyrisme intime, personnel et très musical. Avec l'avènement du romantisme, et jusqu'en 1833, date de la publication d'un troisième volume de poésies inédites (*Les Pleurs*) Desbordes-Valmore jouit bien vite d'un crédit considérable. En dépit du groupe romantique, Sainte-Beuve en tête, qui voit alors en elle une Sapho désespérée le public aime surtout en Desbordes-Valmore une forme atténuée du romantisme, la poétesse du foyer et des enfants. Le goût de ce même public changeant assez vite Desbordes-Valmore sera par la suite rapidement oubliée, mais comme elle continue à écrire des poésies dont la musique cherche à rendre la mélodie de l'âme et d'une vie intérieure riche en rêves et en souvenirs, elle trouve en Sainte-Beuve et Baudelaire de nouveaux admirateurs. En 1860 avec les *Poésies inédites*, posthumes, la critique commence à parler

de lyrisme intime pur (Montégut), d'art acquis (Barbey d'Aurevilly), d'art inconscient (Lacaussade) d'art inspiré (Baudelaire). Dix ans plus tard Rimbaud trouve dans l'oeuvre de Desbordes-Valmore une vision neuve et Verlaine y distingue une exquise légèreté. On arrive ainsi entre 1894 et 1896 aux années de la réhabilitation de "Marceline." Comme il suit les indications de Verlaine et s'accorde avec les goûts de cette période post-symboliste Montesquiou proclame bruyamment que Desbordes-Valmore est un maître. Cependant certains facteurs, le snobisme de Montesquiou, la publication de la correspondance de la poétesse et une généralisation hâtive des opinions de Sainte-Beuve, déforment le véritable sens de cette réhabilitation. La majorité du public voit en Desbordes-Valmore une romantique passionnée qui avait su, sans art aucun, mais avec spontanéité, chanté son désespoir. Très peu tiennent compte de notions plus nouvelles: valeur humaine, nombre et légèreté du vers, images originales, pré-symbolisme, "correspondances," faculté créatrice du poète. Après la période de popularité qui jusqu'en 1933 suivit la réhabilitation de Desbordes-Valmore, l'époque actuelle n'a retenu cependant que ces dernières notions et appelle Marceline un grand poète.

En résumé Desbordes-Valmore qui n'a jamais été ni tout à fait oubliée ni tout à fait populaire, a par deux fois été admirée du public, entre 1820 et 1833 et 1896-1936, et a toujours été admirée des poètes. C'est qu'il y avait eu à deux reprises entente entre l'oeuvre de Marceline et la sensibilité, d'abord romantique, puis symboliste, du jour, et qu'il y a toujours eu entente entre Desbordes-Valmore et les poètes. Enfin l'heure actuelle place très haut cette muse romantique parce qu'il s'avère qu'en dépit des faiblesses de l'oeuvre la notion de sa valeur n'a cessé de subir une hausse constante. Avec le recul du temps cette poésie dite d'abord inculte s'est révélée féconde et son auteur un vrai poète.

303 pages. \$3.79. MicA 55-177

THE POLICIES OF HERNÁN CORTÉS, AS DESCRIBED IN HIS LETTERS

(Publication No. 10,544)

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University of Illinois, 1954

This study of the policies of Hernán Cortés attempts to deal with five categories of policies. The divisions are: political, military, social, religious and economic. Since the similarity of Cortés' policies to those of Machiavelli and Caesar is very pronounced, a brief comparison of the policies of these men is made in the last chapter.

Cortés' political policies take the form largely of his actions in relation to his enemies, both Indians and Spaniards, and to the Crown and its agencies. Generally native leaders were retained in subjugated tribes. Cortés exercised the policy of extending

universal Spanish Monarchy, and identified his interests with those of the Crown.

In his military policies, Cortés made extensive use of native soldiery. He employed the Biblical idea of conquering by dividing. Artillery and armored horse were his most effective weapons. Native armor was adopted.

Because of the lack of uniformity and understanding of different weapon types and nomenclature of the sixteenth century, the writer has attempted some exposition in this field in the latter part of the second chapter. Also, an attempt has been made to show how weapon types affected military policy. Logistics are also considered. The use of the *tamemes* is noted.

Among the social problems confronting Cortés was that of the relations of the two races that he had brought together. While Cortés does not say so exactly, he apparently fostered a policy of amalgamation of the two races. In unions between Spaniards and Indian women, the Indian woman appears to have been treated rather well, and in some instances as equals. In labor relations, the Indian man generally seemed to occupy an inferior position. Cortés at first opposed the *encomienda*, but later accepted it and urged that it be made perpetual. All evidence indicates that he was planning for the future of the country.

In his religious policies, Cortés gave every indication of being sincere. Contemporary writers bear this out. He stated that the main object of the conquest was the propagation of the faith. He considered himself an instrument in the hands of God. He said that if the conquest were made for any purpose other than the spread of the faith, it would not be justified. His policies of conversion were preaching, teaching, and the use of force where necessary. Submission was to come before conversion. He was especially active against idolatry and the eating of human flesh.

Cortés gave early evidence of the trend of his economic policies. With his arrival at San Juan de Ulloa, he began a search for good harbors and waterways that never ended as long as he engaged in explorations. He made most of materials at hand. The metallic resources of the country were developed. Various manufacturing operations were begun. New species of plant and animal life were brought into the country. Reciprocal trade was encouraged. Repeated efforts were made to discover the strait that was supposed to join the two oceans. Cortés seemed to wish to develop all possible resources.

The comparison between the policies of Cortés, Machiavelli, and Caesar is not intended as a major part of this study, but as an aid in obtaining a better perspective of Cortés' policies. The comparison is first made between the policies of Cortés and Machiavelli, using the *Prince* as a main source for the policies of Machiavelli. For the comparison with the policies of Caesar, the *Commentaries on the Gallic war* and the civil war were used. The eighth *Commentary* by Aulus Hirtius is used to make the transition from the Gallic to the civil war.

A short body of conclusions terminates the study.
376 pages. \$4.70. MicA 55-178

**TWO VISIONS OF CHARACTER AND FATE:
A STUDY OF THEMES AND MAJOR CHARACTERS
IN THE NOVELS OF THOMAS HARDY
AND GEORGE ELIOT**

(Publication No. 9623)

Ted Ray Spivey, Ph.D.
University of Minnesota, 1954

Major Adviser: J. I. Hillhouse

This study of George Eliot and Thomas Hardy centers on their place in the main current of nineteenth-century romanticism. The most important single thing that they have in common is their depiction of the exceptional individual, the term I have chosen to designate the sensitive, talented person who is strongly affected by romantic idealism. Both authors in their novels show exceptional individuals struggling with fate and their own problems (which are often the chief spiritual problems of the age) and at the same time either rebelling against their provincial environment or trying to overcome a feeling of deracination. After a brief discussion of the two authors' intellectual background and a more lengthy discussion of some of their literary techniques and the uses they make of the provincial background, three chapters, the heart of the thesis, are devoted to the different types of exceptional individuals found in their novels. The striving heroes and heroines – those exceptional individuals who struggle within themselves and who also seek to work for the good of man – resemble the heroes of an earlier, triumphant romanticism but are somewhat different because of their inability to accomplish much. In the next chapter those exceptional individuals who suffer from inner struggle and torment and who are analyzed by both authors with psychological insight are examined; these characters are used to produce the tragic effects which both authors sometimes achieve. The following chapter is devoted primarily to the characters who are for the most part either good or bad with the purpose of seeing how these characters are used to re-enforce the authors' ethical views. In these three chapters the characters conceived by the two authors are compared and contrasted in terms of both theme and technique.

In the final chapter the relation between characterization on one hand and ethics and world views on the other is discussed. Hardy's more limited view of the good life is contrasted with George Eliot's more complicated system which calls for a union of reason and feeling. This chapter points up a major topic of the thesis, which is also discussed in earlier chapters: the sympathy both authors feel for romantic idealism and also their distrust of an excess of this idealism. Both come to realize the inadequacy of the romantic ideal and begin to feel their way toward new ideals: a stoic acceptance on George Eliot's part with an emphasis on duty for its own sake and, on Hardy's part, a turning to simple people who are closely associated with nature. Both authors study the self-destructiveness of the romantic hero and

look forward to a new anti-romantic hero whose forte is enduring the blows of fate.

Among the secondary topics of the thesis are the greater importance of characterization in Hardy than many critics imagine and the gradual development of George Eliot from a moralist who sees consequences following evil acts in a cause-and-effect order to the more subtle moralist who examines the complicated motives behind moral choice. The place George Eliot has in the ordered Mid-Victorian world is contrasted with the central position Hardy holds in the new wave of romanticism coming after 1860, which emphasized the irrationality of the universe and called for a new paganism. Both authors are also treated as among the first of the modern English novelists who explored intellectual and spiritual problems, who subjected complicated people to searching analysis, and who dealt with tragedy resulting from flaws of character and the blows of fate. Thus they make way for the novel of the twentieth century.

389 pages. \$4.86. MicA 55-179

**THE WORLD AND GOD: THE POEMS
AND DRAMAS OF FULKE GREVILLE**

(Publication No. 10,135)

John Edward Williams, Ph.D.
University of Missouri, 1954

Supervisor: Donald B. Clark

Fulke Greville, First Lord Brooke, was born into a heritage of service to England. His life spanned four reigns, and he served three monarchs – Elizabeth, James, and Charles – with faithfulness and distinction in a number of capacities. He amassed a great personal fortune during this service, and he exercised a considerable influence on state policies of his time.

Until recently Greville was known largely by his friendship with Philip Sidney, whose *Life* he wrote in 1612. But in the last few years some critics have begun to realize that Greville's friendship with Sidney has obscured Greville's own importance as a poet, and that his true significance lies in the intrinsic worth of his own poetry. Some recent critics have ranked his lyric verse with that of Shakespeare, Jonson, and Donne.

But no critic has yet dealt with Greville as fully as he deserves. Most critics of his didactic poetry have mistaken its significance because they have habitually tried to deal with the ideas in that poetry as if they could be isolated from the poetic form in which they occur. Thus Greville has been variously termed a "Calvinist" or a "Stoic" because a few Calvinist or Stoic notions have been seen in the poems. But Greville's thought cannot be adequately dealt with in this way. If his didactic poems are read as if they are poems rather than politics, theology, or

morality, Greville's position shall be found highly individualistic and complex; it is comprehended neither by Calvin, Bacon, Machiavelli, nor Agrippa, though Greville has certain notions in common with all of these.

Both chronologically and methodologically, Greville's two extant dramas stand between his didactic and lyric practice. The dramas are artistic failures, but they are extremely significant failures – for they show Greville at an awkward position in his search for artistic forms that might contain his insight into man's divided nature. Though his dramas have certain affinities with the French Senecan practice of Robert Garnier, they may also be seen as representing Greville's own divided mind. The dramas tend to be sharply split in a technical sense between the concrete and the abstract, between the general and the specific. The concrete Greville attempts to deal with in the dramatic portions of the dramas, and the abstract he tends to deal with in the Choruses of the dramas. Since Greville's interest at this time was increasingly didactic, the two parts exist almost in isolation; the Chorus becomes the real nucleus of the drama, and the dramatic events become mere commentary upon an action that is external to the drama.

Greville's lyric poetry is his finest and most mature work. Though he is conventionally considered as merely a lesser Petrarchan, close examination of his poetry shows that in his characteristic method he reverts to an older, plainer, more nearly native tradition, as exemplified by such poets as Gascoigne, Raleigh, and Vaux. The peculiar force, power, and strangeness of the poetry is a result of his blending of two traditions – the native and the Petrarchan. The native tradition gave him form, rational structure, and firmness of diction; the Petrarchan method gave him an elaborate verbal texture, a complex system of imagery, and subtly emotive rhythms. In the history of literary method, he is a transition figure, and his lyric practice presages that of later Metaphysical poets such as Donne and Herbert.

161 pages. \$2.01. MicA 55-180

MAUPASSANT IN ENGLAND

(Publication No. 10,567)

George John Worth, Ph.D.
University of Illinois, 1954

Guy de Maupassant first emerged on the English scene in the early 1880's, when those who read French literature in the original and the periodicals that dealt with current developments in French letters

were becoming aware of him as a talented, if at times excessively Gallic, *conteur* in the tradition of Flaubert and the French naturalists. Nothing by him was translated until the late 1880's, and the early volumes of Maupassant in English were, for the most part, quite unsatisfactory. Either they were badly bowdlerized or they were dashed off by ill-equipped translators with an imperfect knowledge of the French language and no real feeling for the English. Far more important than these translations in bringing Maupassant to the attention of the intelligent English public of the nineteenth century were the writings of such eminent critics as Saintsbury, James, Gosse, and Symonds; these critics by their authority established him as a writer worthy of the most serious consideration. In the 1890's, during one of the Francophile eras which occur periodically in the history of English literature, Maupassant's *oeuvre* struck a particularly responsive chord in those English writers who were bent on faithfully mirroring reality, however grim or unpleasant it might be, in their work, who strove to find the best possible means to achieve this end, and who found in the short story, a genre previously not much cultivated in England, a particularly congenial medium.

English critics found little to say about Maupassant during the first two decades of the twentieth century: he was tacitly accepted as a master of the short story and a minor classic of world literature. But in the 1920's, stimulated by the appearance of two collected editions of Maupassant's works, several single volumes of his short stories, and two biographies, critics and reviewers began once more to deal with him extensively. Although he was praised for his strikingly vivid representation of life and his masterly way of telling a story, he had relatively few followers among the literary avant-garde: Chekhov was now fashionable in the same manner as Maupassant had been in the 1890's. Nevertheless, during the past quarter-century there has been no doubt among English critics of Maupassant's permanently high standing in the annals of the literature of his period.

Maupassant's impact on English literature has made itself felt in two ways. First, he has done a great deal to bring the short story into repute in England, and he has helped to mould its subject matter and technique. In the second place, he has directly affected, at crucial stages of their careers, at least five important modern English writers: Arnold Bennett, Joseph Conrad, Ford Madox Ford, Henry James, and W. Somerset Maugham. This influence is attested to in their letters, notebooks, prefaces, and critical writings, and it may be discerned in their fiction.

310 pages. \$3.88. MicA 55-181

MATHEMATICS

METRIC CHARACTERIZATIONS OF ELLIPTIC n -SPACE

(Publication No. 10,114)

Joe D. Hankins, Ph.D.
University of Missouri, 1954

The systematic study of distance geometry may be said to have begun in 1928 with the appearance of K. Menger's "Untersuchungen über allgemeine Metrik". It was natural that those properties of the metrics of the familiar spaces which serve to distinguish those spaces from all the other members of the class of semimetric spaces should have been sought. Such problems can be formulated in two parts as follows:

1. What are necessary and sufficient metric conditions that an arbitrary semimetric n -tuple of points be congruently contained in a given semimetric space? (Finite problem).

2. What are necessary and sufficient metric conditions that an arbitrary semimetric space be congruent to a given semimetric space? (Space problem).

Menger answered both questions for n -dimensional euclidean space and Blumenthal has investigated and solved the corresponding questions as they apply to n -dimensional spherical, hyperbolic and elliptic spaces.

In solving the space problem for elliptic space ("Metric Characterization of Elliptic Space, "Transactions of the American Mathematical Society, 59:381-400, 1946.), Blumenthal used a condition to the effect that each of a certain restricted class of quintuples (of points) be congruently imbeddable in elliptic space. As a concluding remark in the paper referred to above, Blumenthal suggested that perhaps a simpler four-point property, Property IA below, could be used in place of the five-point property to obtain a characterization of elliptic space but that there seemed to be some difficulty in achieving this result.

In the thesis it is shown that this result can be obtained in the manner suggested by Blumenthal. Specifically, it is shown that if a complete, convex, semimetric space has its diameter less than or equal to $\pi r/2$ and if it satisfies

Property IA. Each quadruple of points containing a linear triple is congruently contained in elliptic n -space of space constant r .

and

Property II. If points p, q are such that $0 < pq < \pi r/2$ then there exist points $d(p), d(q)$ such that the relations $pqd(p), qpd(q)$ and $qd(q) = pd(p) = \pi r/2$ subsist.

then each n -dimensional subspace of the given space is congruent to n -dimensional elliptic space of space

constant r . Furthermore, it is shown that if the given space is complete, convex, metric, has a diameter less than or equal to $\pi r/2$, satisfies Property II and any one of the following properties (which are weaker than Property IA):

Property IC. If p_1, p_2, p_3, p_4 denote pairwise distinct elements of the given space such that $p_2 p_3 p_4, p_2 p_3 = p_3 p_4$ and with the perimeter of every triple of p_1, p_2, p_3, p_4 less than $\pi r + \epsilon$ (ϵ a fixed positive number), then $p_1, p_2, p_3, p_4 \in E_{n,r}$.

Property ID. If p_1, p_2, p_3, p_4 denote pairwise distinct elements of the given space such that $p_1 p_2 = p_1 p_4$ and $p_2 p_3 p_4$ or if p_1, p_2, p_3, p_4 contains two linear triples, then $p_1, p_2, p_3, p_4 \in E_{n,r}$.

Property IE. If p_1, p_2, p_3, p_4 denote pairwise distinct elements of the given space such that (i) $p_1 p_2 = p_1 p_4, p_2 p_3 p_4$ and $p_1 p_2 = p_3 p_4$ or (ii) $p_1 p_2 = p_1 p_3, p_2 p_3 p_4$ and $p_2 p_3 = 2p_3 p_4$ or (iii) p_1, p_2, p_3, p_4 contains two linear triples, then $p_1, p_2, p_3, p_4 \in E_{n,r}$.

then the given space, again, has its n -dimensional subspaces congruent to n -dimensional elliptic space of space constant r .

Since the finite problem for elliptic space has been solved, each of these four-point conditions can be translated into a condition on the distance set of semimetric quadruples. Thus, new metric characterizations of elliptic space result.

58 pages. \$1.00. MicA 55-182

ON INVARIANT MEANS OVER TOPOLOGICAL SEMIGROUPS

(Publication No. 10,538)

William G. Rosen, Ph.D.
University of Illinois, 1954

A C -mean on a topological semigroup Σ is a positive element of norm one in $C(\Sigma)^*$, where $C(\Sigma)$ is the Banach algebra of all real valued, continuous, bounded functions on Σ . Σ is called WCR if its right and left regular representations over $C(\Sigma)$ are weakly continuous. Discrete and compact semigroups are WCR. A theorem by Day (Trans. Amer. Math. Soc., vol. 69 (1950), pp. 276 - 291) about discrete semigroups is extended to WCR semigroups.

Theorem: If Σ is a WCR semigroup, then there is an invariant C -mean if and only if every bounded, weakly continuous, right and left representation of Σ is w^* -ergodic, and if and only if the right and left regular representations of Σ over $C(\Sigma)$ are w^* -ergodic. An element $x \in C(\Sigma)$ is right uniformly continuous if $|(r_t x)(s) - (r_t x)(s')|$ approaches zero uniformly in t as s approaches s' . Left uniform continuity is dually defined, and $U(\Sigma)$ denotes the set

of all uniformly continuous functions on Σ . Theorem: The following conditions on a topological semigroup Σ are equivalent; (a) the right and left regular representations of Σ over $U(\Sigma)$ are w^* -ergodic, (b) every strongly continuous, bounded, right and left representation of Σ is w^* -ergodic, (c) there is an invariant positive element of norm one in $U(\Sigma)^*$.

An element $x \in C(\Sigma)$ is almost convergent if all invariant C -means assume the same value at x .

Theorem: If Σ is a WCR semigroup with an invariant C -mean, then an element $x \in C(\Sigma)$ is almost convergent if and only if x lies in the ergodic subspace of the right and left regular representations.

Corollary: An invariant C -mean is unique if and only if every element of $C(\Sigma)$ is ergodic.

Theorem: If Σ is compact, then Σ is WCR, and every element of $C(\Sigma)$ is uniformly continuous.

Theorem: A compact semigroup has a right invariant mean if and only if it contains a unique minimal left ideal.

Corollary: A compact semigroup Σ has an invariant C -mean if and only if the kernel of Σ (see Numakura, Math. J. of Okayama U., vol. 1 (1952), pp. 99 - 108) is a group. If such a mean exists, it is unique.

Theorem: The kernel of a compact semigroup is a direct product as regards its topology, its algebraic structure, and its measure.

Theorem: If a right invariant mean on a compact semigroup is unique, then it is two-sided invariant.

40 pages. \$1.00. MicA 55-183

MUSIC

AN ANALYTICAL STUDY OF THE PRINCIPAL INSTRUMENTAL COMPOSITIONS OF WALLINGFORD RIEGGER

(Publication No. 10,318)

Joseph Benjamin Schmoll, Ph.D.
Northwestern University, 1954

Wallingford Riegger, an American composer, was born in Albany, Georgia, on April 29, 1885. Educated in the United States and Europe, he wrote his first mature composition, Trio for Piano, Violin and Cello, Opus 1, in 1919-20. This composition won the Paderewski prize. Today he is known as a composer who employs the more radical techniques of composition.

The author found no books and few magazine articles to guide him, so he has relied chiefly upon his own analysis of the music in forming the conclusions which are presented here.

Melody

1. The contours of Riegger's melodies follow no well-defined curve.
2. Phrases are usually two or three measures in length.
3. There is much rhythmic variety in Riegger's melodies.
4. His favorite melodic interval appears to be the minor second.
5. Octave displacement of conjunct movement is typical of Riegger's composition.
6. Rests are an integral part of over one-half of his melodies.

Tonal Centers

1. In Riegger's conservative compositions tonal centers can be located.

2. In his more radical compositions tonal centers are difficult to locate.

Tempo, Meter and Rhythm

1. There are a great many tempo changes in Riegger's compositions.
2. Tempo, in most cases, is very accurately indicated.
3. The quantity of meter changes varies with each composition. Many of the longer compositions have approximately twenty or more changes. Some have none and others have well over 100.
4. Unusual meters, such as $\frac{2 \frac{1}{2}}{4}$, $\frac{11}{16}$, are used, but the more familiar meters predominate.
5. Rhythmic interest is often achieved by a fluctuation of agreement and disagreement between rhythm and meter.
6. Rhythmic patterns are constantly varied.

Chord Structure

1. Riegger employs tertian structure in conservative compositions. (Most of such compositions are early works.)
2. Chords of the fourth or fifth appear chiefly in his piano music.
3. Chords of mixed intervals predominate in his radical compositions.
4. Tone clusters appear occasionally.

Counterpoint

1. In contrapuntal usage Riegger varies his twelve-tone rows by inversion, retrogression, inverted retrogression, and transposition.
2. He uses notes of the twelve-tone row in octaves, and repeats notes, and groups of notes of the row many times.

3. Sometimes only part of a composition is based upon a tone row.

4. Riegger occasionally uses an incomplete tone row. Dichotomy, for example, is based upon an eleven-tone row.

5. He uses imitation a great deal. Sometimes the imitation is free, but usually it is canonic.

6. In his later works, melodies of the counterpoint are formed by parallel similarly-constructed sonorities. These sonorities are variously tertian structures, chords of the fourth or fifth, seconds, tone clusters and chords of mixed intervals.

7. Riegger's style, for the most part, is contrapuntal rather than harmonic.

Form

1. Riegger uses few themes within a single composition, and develops them at great length.

2. Many of the compositions employing the twelve-tone row throughout are in variation form.

3. Variation form is used for many compositions not employing the twelve-tone row.

4. Few compositions come under the classification "Free Form."

5. Riegger generally uses traditional forms, but with great freedom.

348 pages. \$4.35. Mic 55-6

THE HISTORY AND PRACTICE OF ENSEMBLE MUSIC FOR LIP-REED INSTRUMENTS

(Publication No. 10,246)

Willard A. Starkey, Ph.D.
State University of Iowa, 1954

Chairman: Professor Himie Voxman

Two factors were influential in the choice of the subject of this study. First, the increased interest in brass ensembles exhibited by music educators in the United States during the last quarter century suggested a need for a comprehensive reference

work on the history of the brass instruments and their use in ensemble, together with a listing of the music written for and played by them. Secondly, an investigation of the available material revealed that such information was to be found only in widely scattered sources, many of which were in foreign languages, thus necessitating a considerable amount of research in order to obtain a clear view of the subject. Furthermore, historical data concerning both instruments and compositions often contain inconsistencies, and an attempt to clarify some of the conflicting statements was considered to be desirable.

Throughout the body of this study the term "lip-reed instruments" has been adopted, rather than the more common term "brass instruments," in order to include some instruments, not made of metal, on which tones are produced in a manner similar to that of the present-day trumpet and trombone. Such instruments include the zink or cornett and varieties of the serpent, a larger co-member of the cornett family.

This study attempts (1) to trace, in so far as possible, the history of the lip-reed instruments in Western civilization from earliest times to the present, with particular emphasis on their use in combinations of completely or predominantly lip-reed instrumentation, (2) to discuss performance practices of such groups and their place in the musical life of each period, and (3) to survey the literature that is known to have been performed by these ensembles, listing the names of composers of lip-reed music.

The Appendix, which runs to almost 150 pages, is considered an integral and important component of this study. The music lists appearing therein are quite extensive, though they cannot be regarded as complete. All original music for lip-reed ensembles that the present writer has been able to find has been included, but only enough of the music in the other categories (as, for instance, music for mixed ensembles of lip-reed instruments and voices) has been listed to give some indications of the performance practices and general repertory of the various periods that included the use of these instruments.

610 pages. \$7.63. Mic 55-7

PHARMACOLOGY

A PHYTOCHEMICAL STUDY OF MATARIQUE

(Publication No. 10,334)

Bertha Baron, Ph.D.
Purdue University, 1944

Major Professor: G. L. Jenkins

Matarique, *Cacalia decomposita*, A. Gray, grows in the Santa Cruz Mountains and in Mapula, Chihuahua, Mexico. Its use dates back to the Yaqui Indians, who called it "maturin," meaning pain killer. Altamirano describes it as a herbaceous plant with a fibrous rhizome and a woody stem somewhat noded, erect, cylindrically angular, woolly at the base, and the rest glabrate.

The rhizomes and roots at the present time are being used by the laity for diabetes mellitus with promising results. The drug was first introduced into Mexico City in 1887 by Guereña. General C. Pacheco recommended matarique as a laxative, vulnerary, anti-rheumatic, odontalgic, and especially for gouty pains. The result of the work done on matarique by General C. Pacheco led to the beginning of plant analysis at the Instituto Medico in Mexico City.

Henckel, a chemist in England, reported finding a glycoside, glucose, resin, volatile oil, and tannin; he stated that the glycoside acted on frogs in a manner similar to that of digitalis. Lozano y Castro reported besides the constituents reported by Henckel, an alkaloid, two acid resins, and fat. Rio de la Loza reported gum, resin, glucose, essential oil, mineral salts, and a crystalline substance, soluble in acidulated water, which imparted a yellow color to sulfuric acid.

In 1890 a pharmacological report was made by Drs. Sosa and Jofre. They stated that the active principle of matarique had a paralyzing action on the motor system and on the heart and that on dogs the action is first noted on the heart, the rhythm of the movements was disturbed and the blood pressure was lowered, then the action was noted on the motor muscles and less markedly on the sensory nerves.

SUMMARY AND CONCLUSIONS

1. A histological study of the transverse section of the root was made.
2. The moisture, ash, and extractives yielded to various successive solvents by matarique were determined.
3. The volatile oil was obtained and its specific gravity, refractive index, ester value, and boiling point were determined.
4. The petroleum ether extract of the alcoholic

extract yielded palmitic, arachidic, linolenic, and oleic acids and sterols.

5. The following crystalline compounds have been isolated from matarique:

a. A sterol consisting of clusters of pale yellow needles, obtained from the petroleum ether extract, having a melting point of 197°C . and a molecular weight of 482.63.

b. A sterol consisting of small white needles obtained from an alcoholic extract, having a melting point of 180°C . and a molecular weight of 441.84.

c. A sterol consisting of creamy white needles, obtained from the same alcoholic extract as the orange-red ketone after the separation of the ketone, having a melting point of $188-189^{\circ}\text{C}$. and a molecular weight of 266.90.

d. A ketone consisting of clusters of orange-red needles, obtained from an eighty per cent alcoholic extract, having a melting point of $121.1-122.5^{\circ}\text{C}$. and a molecular weight of 342.5.

e. A ketone consisting of creamy white crystals, obtained from the orange-tan powder fraction of the ether extract, having a melting point of $181-182^{\circ}\text{C}$. and a molecular weight of 69.21.

f. Two water-soluble compounds, one being straw colored needles with a slight fluorescence and a melting point of $141.4-142.2^{\circ}\text{C}$., and the other very minute, white, cottonlike needles that did not have a definite melting point but changed in volume at $131.2-133^{\circ}\text{C}$. and decomposed with foaming at about 210°C .

6. Specific tests indicated that matarique did not contain an alkaloid.

7. Specific tests indicated the presence of a glycoside.

8. Pharmacological tests indicated that the orange-red ketone produced a slight anesthetic action and that the tincture had a slight cardiac action. It was also indicated that there was a constituent present in the fluid extract, tincture, and in an alcoholic extract that acted in a manner similar to digitalis in that it produced prolonged systolic movements and heart block. No effect on blood pressure was observed.

70 pages. \$1.00. MicA 55-184

A PHARMACOGNOSTICAL STUDY OF VALERIAN

(Publication No. 10,335)

Ling Chen, Ph.D.
Purdue University, 1947

Major Professors: C. J. Zufall and G. L. Jenkins

Valerian, one of the most important sedative, antispasmodic and antihysterical drugs of the vegetable origin, has been used especially in Europe for centuries. Valerian consists of the rhizome and roots of *Valeriana officinalis*, L. and has been official in many pharmacopoeias.

Valerian is a widely distributed medicinal plant. It has also been cultivated in different parts of the world.

Synonyms for the official and the other varieties and species of *Valeriana* are numerous. Tables with references are prepared for the distribution and synonyms of valerian.

A great deal of work done on the pharmacology of valerian, its galenical preparations, its volatile oils, alkaloids and valerates is reviewed. The opinions of the modern physicians as to the therapeutic value of valerian are collected and are discussed.

The constituents of valerian mentioned in the literature have been reviewed. The isolation of the most important constituents, such as, the alkaloids and the glucosides is summarized and is discussed.

EXPERIMENTAL

Preliminary Examinations

Powdered valerian roots, N.F. supplied by the S. B. Penick & Co. were used for the following determinations: Ash, Moisture, Extractives, Volatile Oil, Successive Extractives, Alkaloid, Reducing Sugar, Tannin and Phenolic Compound, and Protein.

SUMMARY AND CONCLUSION

1. All substances giving positive tests with alkaloidal precipitants in valerian are soluble both in alcohol and in 50° C. hot distilled water.
2. The aqueous soluble portion of alcohol extract, after being made alkaline, was extracted by shaking successively with petroleum ether, ether, chloroform and amyl alcohol. All portions, except the petroleum ether extract, including the remaining alkaline aqueous portion, gave positive tests with alkaloidal precipitants. The tannic acid precipitate of the amyl alcohol extract and the remaining alkaline aqueous portion gave positive test for nitrogen.
3. An organic crystalline compound, m.p. 271°-273° d., was isolated and some of its physical and chemical properties determined but the amount was extremely small.
4. Isolation of the crude alkaloidal substances by adsorption on Lloyd's reagent and florisil were only partially successful.

5. By precipitation with Mayer's reagent and with picric acid, fair results were obtained in securing the alkaloidal substances.
6. Tannic acid was found not suitable as a precipitant for the isolation of alkaloidal substance due to the poor recovery.
7. The electro-dialysis with adsorption method, developed by Leyva (1939) for the isolation of alkaloids and organic bases, was tried on the aqueous soluble portion of the alcoholic extract of valerian. One drop of an oily liquid with a pyridine-like odor, possibly the volatile base acetyl pyrrole of Chichibabin, was obtained from the ether-soluble portion of the aqueous alkaline solution surrounding the cathode after electro-dialysis. No significant amount of the substances passing through the cellophane membrane gave positive tests for alkaloids. This method therefore was not useful for the isolation of alkaloidal substances present in valerian.
8. An impure white amorphous product was obtained from the petroleum ether extract of valerian.

224 pages. \$2.80. MicA 55-185

THE SYNTHESIS OF METHIONIC ACID
DERIVATIVES OF NITROGEN HETEROCYCLIC
AND RELATED COMPOUNDS

(Publication No. 10,336)

Ke-Chuan Ke, Ph.D.
Purdue University, 1948Major Professors: John E. Christian and
Glenn L. Jenkins

Many nitrogen heterocyclic compounds and their derivatives have long been known as important medicinals and insecticides. Among them alkaloids are most important examples and are derivatives of pyridine, pyrrolidine, quinoline, etc. These alkaloids are effective in chemotherapy, and thus are of special interest to the pharmaceutical chemist.

Organic sulfonic acids or their derivatives possess antiseptic properties. One of the most important developments in the history of chemotherapy was the discovery of the antibacterial powers of sulfanilamide and its derivatives of nitrogen heterocyclic compounds.

Methionic acid, methanedisulfonic acid, contains two sulfonic acid groups attached to a single carbon atom. It has been considered to be pharmacologically interesting and analogous to malonic acid, which is the mother structure of a number of hypnotics.

In the search for new active chemotherapeutic agents, it would seem rational to synthesize compounds having a structure which included the combination of methanedisulfonyl with nitrogen heterocycles.

A survey of the literature revealed that compounds of the type $R\text{CN.O}_2\text{S-CH}_2\text{-SO}_2\text{NCR}$ and their alkyl

substituted derivatives have never been prepared, and compounds of the type $R\text{C}\equiv\text{N}\cdot\text{HN}\cdot\text{O}_2\text{S}\cdot\text{CH}_2\cdot\text{SO}_2\cdot\text{NH}\cdot\text{N}\equiv\text{C}\cdot\text{R}$ have been prepared in only a few instances. The former type of compound is synthesized by the reaction of methionyl chloride with a nitrogenheterocyclic compound in which the nitrogen must be basic with a hydrogen atom attached to it, while the latter type can be prepared by the reaction of methionyl chloride with an amino-nitrogen-heterocyclic compound.

Methods for the synthesis of the following methionic acid derivatives of nitrogen heterocyclic compounds are described along with yields, properties and analytical data:

Methanedisulfonpiperdide, Methanedisulfonmorpholide, Methionic Acid, Methionyl Chloride, Piperidine, Methanedisulfonpiperidide, Tetrahydroquinolide, Methanedisulfonpipercolide, Methanedisulfonthallide, Methanedisulfondecahydroquinolide, Methanedisulfonphenothiazide, Methanedisulfon 2,4-dimethylpiperidide, Methanedisulfon- γ -pipercolide, Monomethylmethanedisulfonpiperidide, Dimethylmethanedisulfonpiperidide, N,N'-Bis(3-methyl-2-pyridyl)methionamide, N,N'-Bis(4-methyl-2-pyridyl)-methionamide, N,N'-Bis(2-benzimidazolyl)methionamide, N,N'-Bis(5-carbethoxy-2-thiazolyl)methionamide, N,N'-Bis(2-benzothiazolyl)methionamide, and N,N'-Bis(5-methyl-2-pyridyl)methionamide.

Sufficient quantities of these compounds have been prepared for bacteriological and pharmacological testing. 73 pages. \$1.00. MicA 55-186

SULFONAMIDE DERIVATIVES OF BENZO(h)QUINOLINE

(Publication No. 10,339)

William Thomas Spain, Ph.D.
Purdue University, 1945

Major Professor: G. L. Jenkins

Introduction

It has been shown that a number of quinoline and acridine derivatives - pamaquine, quinacrine, and certain quinoline and benzoquinoline substitutes with dialkylaminoalkylamino side chains possess a strong antimalarial action. The use of sulfonamides has been well established in the treatment of a variety of infections. Therefore, it seemed desirable to investigate the synthesis of benzoquinolines containing in addition to the dialkylaminoalkylamino side chain a sulfonamide group to which the dialkylaminoalkyl side chain was attached.

Most of the work previously published has involved substitutions on the 2- and 4- positions of the benzo(h)-quinoline nucleus. This investigation involves the synthesis and study of substitutions at the 6-, 7- and 10- positions in benzo(h)quinoline.

Three new benzo(h)quinoline-sulfonic acids have been prepared in this study, namely,

benzo(h)quinoline-6-sulfonic acid, benzo(h)quinoline-7-sulfonic acid, and benzo(h)quinoline-10-sulfonic acid. The general procedure for the preparation of benzo(h)quinoline is by the Skraup synthesis on 1-naphthylamine and/or its substituted components.

6-Bromobenzo(h)quinoline has been prepared in fair yields from 4-bromo-1-naphthylamine. By modification of the Skraup reaction this compound has been prepared in greater yields. Benzo(h)-quinoline-6-sulfonic acid was prepared from 1-naphthylamine-4-sulfonic acid by the Skraup reaction and also by the Conrad and Limpach procedure. The methyl and hydroxyl groups were removed from the benzo(h)quinoline derivatives by the procedure described by Gobeil and Hamilton. Benzo(h)-quinoline-7-sulfonic acid and benzo(h)quinoline-10-sulfonic acid were also prepared by a modified Skraup reaction on 1-naphthylamine-5-sulfonic acid and 1-naphthylamine-8-sulfonic acid, respectively.

The benzo(h)quinoline-sulfonic acids were converted to their sodium salts by treating with sodium hydroxide and to their respective sulfonyl chlorides by reaction with phosphorus pentachloride.

Three previously known dialkylaminoalkylamines were prepared, namely, diethylaminoethylamine, γ -diethylaminopropylamine, and δ -diethylaminobutylamine. Diethylaminoethylamine was prepared by the procedure described by Magidson and Grigorowsky. A more recent procedure by Wilson was also used which in our hands has proven to be both time saving and more efficient. γ -Diethylaminopropylamine was prepared also by the dialkylaminoalkyl phthalimide synthesis as described by Shriner and Hickey. δ -Diethylaminobutylamine was prepared by the reduction of γ -diethylaminobutyronitrile according to the procedure of Huber.

Condensation of benzo(h)quinoline-6-, 7-, and 10-sulfonyl chlorides with the above three diamines yielded nine new benzo(h)quinoline(dialkylaminoalkyl)-sulfonamides. The substitution of the sulfonamide group on the benzo(h)quinoline nucleus to which the dialkylaminoalkyl side chain was attached theoretically should produce compounds with possible desirable therapeutic properties.

Conclusions

1. Three new benzo(h)quinoline-sulfonic acids have been prepared by a modified Skraup reaction or the Conrad and Limpach procedure, namely, benzo(h)quinoline-6-sulfonic acid, benzo(h)quinoline-7-sulfonic acid, and benzo(h)quinoline-10-sulfonic acid.

2. The respective sulfonyl chloride of the three benzo(h)quinoline-sulfonic acids have also been prepared by reaction with phosphorus pentachloride, namely, benzo(h)quinoline-6-sulfonyl chloride, benzo(h)quinoline-7-sulfonyl chloride, and benzo(h)-quinoline-10-sulfonyl chloride.

3. Three previously known dialkylaminoalkylamines were prepared by the Gabriel phthalimide of dialkylaminonitrile intermediates to give diethylaminoethylamine, γ -diethylaminopropylamine, and δ -diethylaminobutylamine.

4. Condensation has been effected between the

benzo(h)quinoline-sulfonyl chlorides and the dialkyl-aminoalkylamines to give nine new sulfonamide derivatives of benzo(h)quinoline.

59 pages. \$1.00. MicA 55-187

A PHYTOCHEMICAL AND PHARMACOLOGICAL STUDY OF MATARIQUE

(Publication No. 10,340)

Chi-Tao Wang, Ph.D.
Purdue University, 1949

Major Professor: G. E. Cwalina

A volatile oil, chiefly the diterpene $C_{24}H_{32}$, was obtained from the petroleum ether extract by distillation at 75-80° (1-2 mm).

Oleic acid, isolated from the petroleum ether extract, was characterized by conversion to 9,10-dihydroxystearic acid.

The presence of palmitic and stearic acids in the petroleum ether extract was indicated on the basis of the melting points of the mixed ethyl esters and the neutralization equivalents.

From the petroleum ether-soluble resin there was obtained by sublimation at 2 mm. a white compound, m.p. 175-176°. The formula $C_{18}H_{23}O_4$ is proposed for the substance.

From the resin which had been subjected to vacuum sublimation a yellow solid was separated by crystallization procedures. This substance was a ketone melting at 184° and gave a 2,4-dinitrophenyl-hydrazone melting at 175-177°. The formula $C_{13}H_{16}O_3$ is proposed for it.

The Stas-Otto procedure failed to detect any alkaloid in the drug.

The Borquelot procedure for detecting glucosides

did not give any evidence for the presence of glucosides but did reveal small quantities of enzyme-hydrolyzable di- or polysaccharides.

A water extract of defatted matarique yielded a white polysaccharide whose products of hydrolysis were investigated qualitatively. The polysaccharide consisted mainly of ketose, probably fructose, units but it also contained aldose units. The amount of ketose was about 25 times the amount of aldose.

Pharmacological studies were concentrated chiefly on the anti-diabetic activity of the water extract since this was the form in which the drug was claimed to produce beneficial results in diabetes. Preliminary tests employing hydro-alcoholic and water extractives in rabbits showed a slight lowering of blood-sugar levels. Subcutaneous injection of the polysaccharides into alloxan-diabetic rats produced no anti-diabetic effect as measured by blood sugar levels. Oral administration of the polysaccharide to severely diabetic rats did not affect the blood sugar in any consistent manner.

The white compound, m.p. 140-141°, previously isolated by Chen was purified further. Structure studies revealed the presence of two free hydroxyl groups and two methoxyl groups. This constituent of matarique resembles in many respects ammosesin, $C_{18}H_{24}O_3$, obtained from the gum resin of *Dorema ammoniacum*.

Baron's orange-red ketone, m.p. 121-122.5°, was studied further. The ketone was found to be a flavonone-type pigment with one methoxyl group. Spectroscopic studies indicated the absence of free hydroxyl groups. The absorption bands of the pigment were different from those of any known flavonone. The orange-red ketone appears to be a new flavonone.

Baron's sterol, m.p. 197°, was further purified. Elementary analysis and molecular weight determinations indicate a formula of $C_{31}H_{46}O_6$ for this substance.
79 pages. \$1.00. MicA 55-188

PHILOSOPHY

THE LEGAL PHILOSOPHY OF HANS Kelsen

(Publication No. 10,573)

Edward Jerome Bloustein, Ph.D.
Cornell University, 1954

The writer treats Kelsen's Pure Theory of Law as an attempt to provide a logical analysis of a class of statements, those which we may call legal statements. As against two historically important views of the meaning of legal statements Kelsen offers a third. Natural Law Theory, he thinks, holds that the statement of law "It is forbidden to go over 50 miles per hour" means something like "It is morally wrong or irresponsible to go over 50 miles per hour."

Empirical or Sociological Theories of Law, he thinks, hold it means something like "If you go over 50 miles per hour, you will probably be arrested and fined." One theory holds that a statement of law is really a moral statement, while the other theory holds that it is really an empirical statement. Kelsen argues that legal statements are neither moral statements nor empirical statements, but that they have their own distinctive logical character.

The examination of Kelsen's position is divided into two parts; one is devoted to his polemical arguments, while the other is devoted to his positive analysis of Law. The writer finds that there are two major weaknesses in the polemical arguments: (1) In comparing legal statements with statements of moral

obligation and statements of empirical obligation, Kelsen neglects to distinguish between at least three kinds of legal statements. (2) In his comparison he also neglects to distinguish between at least the following logical characteristics of statements: Their meaning, the evidence for them, their implications, and the conditions of their significant use. His polemical positions, on the whole, are found to be well taken, but because of his failure to make the distinctions cited they suffer from lack of clarity and the omission of certain lines of argument essential to them. They are also wrong or misleading in some respects.

The following findings are made concerning Kelsen's positive analysis of Law: (1) He is wrong in believing that every law is a prescription to a law officer to execute a sanction against some subject of law. It is true that some laws must be of this character, but this is not true of all of them. (2) Although he is correct in his view that law regulates its own creation, he is wrong in thinking that it is a consequence of this view that we must suppose some basic, though non-existent, norm which regulates the creation of an historically first constitution. (3) His description of "efficacy" as a condition of an order of norms being a legal order is inadequate. It is true, however, that some such condition as he calls "efficacy" is necessary to the description of a legal order.

Notwithstanding the weaknesses of Kelsen's theory, the writer finds that he has made a major contribution to the philosophic study of Law. First, he has shown by the example of his own work that a theory about the meaning of legal statements is different in kind from either (a) a description of the law of some country or countries; or (b) an explanation of why men make, obey or enforce laws; or (c) a theory of the moral ends laws should serve. Secondly his view that Law is pure of Morals and Empirical Science – however obscure it may be – provides a remarkably fruitful insight into the nature of legal statements; namely, that they are different in their logical character from either moral statements or statements of empirical science. It is chiefly for these two reasons that the author regards Kelsen so highly as a philosopher of Law.

254 pages. \$3.18. MicA 55-189

MILL AND FRENCH THOUGHT: BEING A
STUDY OF THE INFLUENCE OF
FRENCH THOUGHT ON THE DEVELOPMENT
OF JOHN STUART MILL'S
POLITICAL AND SOCIAL PHILOSOPHY

(Publication No. 10,526)

Iris Wessel Mueller, Ph.D.
University of Illinois, 1954

In 1820, John Stuart Mill spent a year in France thus initiating his lasting interest in French thought and social movements. But it was not until after his return to England, when he experienced a disillusionment with the creed of the Benthamites and that of

the English conservatives, that he turned for inspiration toward and began to feel the influence of such French theoreticians as the Saint-Simonians, Auguste Comte, Alexis de Tocqueville, and of the political upheavals of 1830 and 1848.

Mill's study of these French movements and French ideas centered on the problem that eventually became the principal subject of his major works, the problem of determining the proper limits of intervention by external authority in the life of the individual. In large part, the ideas he encountered in his study of these French analysts and the political movements he observed from 1830 to 1848 determined his final attitude in such culminating works as the *On Liberty*, *Considerations on Representative Government*, *On Social Freedom*, and the last essays on socialism.

After the revolution of 1830, which raised the apparently insoluble dilemma of having to choose between a society governed by a bourgeois oligarchy and a society impelled toward anarchy by an unenlightened mass, Mill was attracted toward the Saint-Simonian and Comtian programs of an authoritative reorganization of society governed by an intellectual elite in the interests of the people. To the end of his life, Mill was influenced by the Saint-Simonian analysis of the economic "laws" and by the Comtian analysis of the historical development of societies, but he rejected those principles which led to the proposal of a rigid, totalitarian system of government. Meanwhile, however, he had read de Tocqueville's *De la Démocratie en Amérique* which, if it convinced him that democracy rather than sociocracy was the future condition of mankind, also brought to his attention the dangers to the individual in a society controlled by the overwhelming influence of an omnipotent majority. From the time of his study of de Tocqueville, Mill began to qualify his advocacy of democracy but he could conceive of no other system to substitute for it. He became particularly dependent upon the safeguards of democratic procedure after his study of the socialist programs of 1848 convinced him of the need for greater government intervention in the lives of the people than he had previously been willing to grant.

Mill's writings after 1850 present his final solution to the problem of deciding which areas of life had to be left open to state intervention in the interests of all the people and which areas of life had to be kept sacred to the complete freedom of the individual if he was to be more than an automaton and the state more than a piece of machinery. Essentially, Mill's conclusion was that only the limited, but highly important, area of speculation could be legitimately defended against authoritative direction or intervention. His conclusion was determined by the conflicting and partial truths he found in the ideas of the Saint-Simonians, Comte, de Tocqueville, Fourier, and Louis Blanc, truths he tried to reconcile in the interests of a society where the individual would have the greatest encouragement and freedom to develop his greatest inner capabilities and a society in which the interests of all would be protected from attacks by a few.

438 pages. \$5.48. MicA 55-190

PHYSICS

PHYSICS, GENERAL

AN EXPERIMENT ON THE TIME VARIATIONS OF COSMIC RAYS UNDERGROUND

(Publication No. 9725)

Mercedes Merner Agogino, Ph.D.
University of New Mexico, 1954

The intensity of three-fold cosmic ray coincidences fifty feet underground at Albuquerque, New Mexico, was measured over a period of one year from March 21, 1953 to March 21, 1954. The equipment consisted of two counter tube telescopes, one directed east and the other west, both making an angle of 45° with the horizontal. The two telescopes were rotated through an angle of 180° each hour, thus interchanging their positions. Any peculiarity of operation of either of the two channels should therefore have affected the results for both the east and the west in the same way. The accumulated counts were recorded separately at the surface for each telescope. The average counting rate for one telescope was about 1600 per hour. During the year's run, data for 255 complete days was obtained. This was analyzed in two ways. First, the solar and sidereal twenty-four hour harmonic components for each day were calculated. These were then combined to find the average amplitude and phase of the solar and sidereal daily waves. In the second method, the pressure-corrected average deviations from the mean of the cosmic-ray intensity during each solar and sidereal hour were calculated. A harmonic analysis of these values was then made to obtain the amplitude and phase of the twenty-four hour and twelve-hour solar and sidereal time variations. Based on a total of some 350,000 coincidences for each telescope for each hour, a standard error of .05% in the calculated amplitudes of the solar and sidereal waves could be expected. If a daily variation with amplitude larger than this standard error does exist, it could be expected to appear in the west with a maximum about six hours later than in the east.

The interpretation of the results is simplified by the fact that the influence of the earth's magnetic field and of some atmospheric effects is greatly reduced for underground measurements due to the high energy of the μ -mesons penetrating so much earth. A minimum of about 100 Bev. is estimated for the energy outside the atmosphere of the primary particles producing the mesons causing the three-fold coincidences measured in this experiment.

Examination of the amplitudes and phases calculated by the two methods of analysis of the data showed no solar or sidereal variation that was both larger than the standard error and also associated with a similar wave of suitably differing phase in the other direction. The experiment, therefore, gave no

positive indication of a solar or sidereal time variation with amplitude larger than the standard error.

78 pages. \$1.00. MicA 55-191

THE SUPERCONDUCTING TRANSITION IN PURE ALUMINUM

(Publication No. 10,459)

John Francis Cochran, Ph.D.
University of Illinois, 1954

Apparatus has been developed to examine the detailed properties of the superconducting transition in superconductors over the range of temperatures 0.8 to 4°K . Temperatures within this range can be measured with a precision of $\pm 10^{-3}^\circ\text{K}$ and maintained constant to $\pm 10^{-4}^\circ\text{K}$.

The critical field curve was measured for four single crystalline specimens of pure aluminum and one polycrystalline specimen of pure aluminum. The critical field curve was the same for each of the specimens, and could be represented by the formula

$$H_c = H_0 \left(1 - \left(\frac{T}{T_c}\right)^2\right),$$

where $H_0 = 98.4 \pm .2$ gauss,

and $T_c = 1.173 \pm .001^\circ\text{K}$.

The degree of supercooling in aluminum (defined as $\frac{H_c^2 - H_s^2}{H_c^2}$, where H_s is the value of the magnetic field for the transition normal to superconducting) was large, and was found to be a reproducible characteristic of a given specimen. One single crystal was found to have two supercooled transition fields, H_{s1} and H_{s2} , over most of the temperature interval investigated. The supercooled transition occurred at the larger of the two fields (H_{s1}), unless the sample was subjected to a magnetic field greater than a critical value, Q . The application of a field greater than Q caused the transition to take place at the lower supercooled transition field, H_{s2} . No explanation was found for this behavior.

104 pages. \$1.30. MicA 55-192

THE EFFECT OF PRESSURE ON THE SUPERCONDUCTING TRANSITION OF TIN

(Publication No. 10,478)

Meyer Garber, Ph.D.
University of Illinois, 1954

The pressure-induced displacement of the superconducting critical field curve of tin has been

measured using liquid helium as the pressure fluid. The procedure followed was to observe the critical field curve over a small temperature range near the critical temperature for several constant pressures. The critical field measurements were made using a sensitive ballistic induction technique. The use of liquid helium as the pressure fluid makes it possible to apply and remove the pressure while the specimen remains at helium temperatures, and also assures that the pressure experienced by the sample is really hydrostatic.

The displacement of the critical temperature with respect to pressure calculated from the observed values of $(\partial H_c / \partial T)_{T_c}$ and $\partial H_c / \partial p$ was $dT_c / dp = 4.40 \pm .20 \times 10^{-5}$ deg./atmos. The measuring method made possible accurate determinations of the critical temperature and the slope of the critical field curve. These values are $T_c = 3.728 \pm .0015^\circ K$ and $(\partial H_c / \partial T)_{T_c} = 149 \pm 1$ gauss/ $^\circ K$. It was also observed that the first application of pressure produced an irreversible shift of the critical field curve of about .1 gauss. The magnitude of this shift was not, however, reproducible. It was necessary to warm the specimen above helium temperatures to restore the zero-pressure critical field curve to its initial position. (Warming the specimen to liquid nitrogen temperature appeared to be sufficient.) In the measurements of the pressure shift, the specimen was cycled several times to the maximum pressure (about 100 atmos.) in order to obtain fairly good reproducibility in the pressure coefficient $\partial H_c / \partial p$.

The most accurate previous determinations of dT_c / dp are too high by approximately 20%. It is suggested that the irreversible shift described above may account for this discrepancy. The present result is compared with the predictions of the recent electron-lattice vibration interaction theory. The theory is not yet sufficiently refined, however, for a detailed comparison with experiment.

62 pages. \$1.00. MicA 55-193

THE CRYSTAL STRUCTURE OF MANGANESE ANTIMONIDE

(Publication No. 10,115)

LeRoy Heaton, Ph.D.
University of Missouri, 1954

Supervisor: Newell S. Gingrich

The crystal structure of Mn_2Sb and the temperature dependence from $100^\circ K$ to $600^\circ K$ of representative reflections were investigated using x-ray diffraction techniques. In order to utilize single crystal methods of structure analysis, single crystals of Mn_2Sb were grown in a gradient furnace constructed for that purpose. Powder, Laue, rotating-crystal, and spectrometric methods were employed. Powder and rotating-crystal diffraction patterns verified the tetragonal unit cell and the values of the lattice constants, $c = 6.56 \text{ \AA}$ and $a = 4.08 \text{ \AA}$.

Measurements of the relative integrated reflections from the (001), (h00), and (hh0) planes were made with a spectrometer equipped with a Geiger-Müller tube for a detector. The reflections were reduced to relative values of F^2 and found to be in agreement for atomic positions of the manganese atoms at $0\ 0\ 0$, $\frac{1}{2}\ \frac{1}{2}\ 0$, $0\ \frac{1}{2}\ \frac{1}{2}$, $\frac{1}{2}\ 0\ \frac{1}{2}$ and the antimony atoms positioned at $0\ \frac{1}{2}\ \frac{1}{2}$, $\frac{1}{2}\ 0\ \frac{1}{2}$, with the exception of very weak reflections detected at angles corresponding to the spacing of (300), (500), and approximately the (100) planes whose intensities should be zero. The source or sources of these reflections were not determined in this investigation. The values of the z parameters were adjusted to give the best fit between calculated and observed values of $F^2(001)$ with the result that z for manganese is 0.295 and z for antimony is -0.280.

A temperature camera assembly was designed and constructed for the spectrometer in order to study the temperature dependence of reflections from sets of planes. The (007) and the (600) planes were chosen for detailed study. The relative integrated reflections from these planes were measured over a temperature range from $100^\circ K$ to $600^\circ K$. An analysis of the data showed that the Debye characteristic temperature along the c -axis is 3.0×10^2 $^\circ K$ and along the a -axis is 2.8×10^2 $^\circ K$. Measurements of the change of angular position of the diffracted peaks with temperature from the (0 0 14) and the (600) planes gave room temperature values of the coefficient of linear expansion as $1.4 \times 10^{-5}/^\circ C$ and $4.0 \times 10^{-5}/^\circ C$ in the direction of the c - and a -axes respectively.

123 pages. \$1.54. MicA 55-194

AN ELECTRON IMPACT STUDY OF BORON TRIFLUORIDE WITH A TIME-OF-FLIGHT MASS SPECTROMETER

(Publication No. 10,429)

Henry Sour Katzenstein, Ph.D.
University of Connecticut, 1954

The anomalous behavior of boron trifluoride counters at high counting rates¹ suggests that dissociative processes in boron trifluoride play a significant role in the operation of such counters, and are responsible for the reported deterioration. As no consistent data^{2,3} is available concerning ionization and dissociation energies in this molecule, a study was undertaken to obtain this information. In addition, the structure of this molecule is, in itself, of interest, since it represents an extreme case of an electron deficient molecule.

The principles of electron impact studies of molecular structure are discussed, together with an outline of the limitations of existing techniques. The design of a new type of mass spectrometer is presented using the time-of-flight mass resolution principle similar to the work of Glenn.⁴ The ion source

is equipped to use the difference current method of Fox and his coworkers,⁵ but without the complicating presence of a source magnetic field. As a collimated ion beam is not required for mass resolution, the source is capable of delivering large ion currents under conditions favorable for measurement of appearance potentials. An instrument of this design was constructed and displayed a mass resolution of the order of one mass unit in one hundred. Ionization potential measurements are readily made to an accuracy of better than one-tenth volt, with no corrections applied.

Experimental results with this instrument on boron trifluoride were obtained despite problems resulting from the high chemical activity of the sample gas. The appearance potential obtained for a BF_2^+ ion from BF_3 was 16.1 ± 0.1 volts; the ionization potential for BF_3 was 16.0 ± 0.2 volts, the error resulting from the extremely small probability for this process.

The high probability for dissociation is thus confirmed. The small difference between the ionization and dissociation energies suggest the presence of a significant amount of polarity in the boron fluorine bond, although the high value for both critical potentials speaks against this. The high electronegativity of the elements involved, however, would tend to account for this. Thus the contribution of an electron pair from coordination with organic compounds would be expected to lower the critical potentials by an amount corresponding to the electron affinity of fluorine, which is indeed observed in measurements on contaminated gas samples. The large difference between the behavior of the contaminated sample and the pure gas confirms the necessity for extreme purification of boron trifluoride used in gaseous discharge devices. 123 pages. \$1.54. MicA 55-195

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PHOTOCONDUCTIVITY IN GERMANIUM AT LIQUID HELIUM TEMPERATURES

(Publication No. 10,523)

Thomas Nolen Morgan, Ph.D.
University of Illinois, 1954

A model of impurity photoconductivity in germanium at low temperatures is developed, interpreted, and applied to the observed response.

The model is built on the accepted band structure of germanium. Donors, acceptors, and traps of

intermediate energy are assumed to be present and to be able to trap and to release electrons or holes. Transition probabilities for the thermal excitation of electrons from donors to the conduction band and to acceptors from the valence band, optical transition probabilities for electron excitation from all levels to the conduction band and to all levels from the valence band, and bimolecular recombination coefficients for the reverse processes are introduced. In terms of these parameters and the equilibrium densities of carriers on the various levels the equations determining the transient photoresponse are derived, solved, and compared with experiment.

The experiments, performed on two high purity n-type samples of germanium at temperatures ranging from 2.2 to 9.0 degrees K, are largely qualitative and are in agreement with the predictions of the model for the photon energies used, 0.5 to 2.0 electron volts.

The response time at low light energies is less than 10^{-4} seconds and is determined by the recombination rate of free electrons with empty donors. Excitation from deeper levels, characterized by times of the order of seconds, releases electrons which distribute themselves between the conduction band and the donors immediately. This donor equilibrium condition introduces a nonlinearity into the relationship between released electron densities and photocurrent and serves to reduce the observed response.

Photon energies only slightly less than the width of the forbidden gap yield a large photocurrent by the release of electrons from acceptors and holes from donors. An equilibrium state between the free hole density and the density of holes on acceptors is established in times comparable to those required for donor equilibrium so that the response time is determined by the trapping rate for electrons on empty (neutral) acceptors and the rate of thermal release of trapped holes to the valence band.

For higher energies the rise is modified by the large free carrier densities, although the decay is principally a sum of the impurity responses.

As the rate of excitation from a deep level decreases with the reduction of the occupation of the level, the rise time is smaller than the decay time and approaches it only as the light intensity approaches zero.

The experiments, in addition to confirming the results predicted from the model, gave some approximate values of the parameters involved. For the donor levels a trapping cross section of approximately 10^{-14} cm^2 at 4.2 degrees K was suggested; for excitation from intermediate levels one or more decay times ranging from about 10 to 50 seconds and suggesting cross sections of 10^{-14} to 10^{-15} cm^2 were observed; and for excitation from acceptors a temperature dependent cross section which rises at low temperatures was found. In the latter case the cross section was about $6 \cdot 10^{-15} \text{ cm}^2$ at 2.2 and $2 \cdot 10^{-15} \text{ cm}^2$ at 2.6 degrees K. At 4.2 and higher temperatures its effect was masked by the thermal release of trapped holes. The response obtained at 9 degrees was too fast to be measured, as is expected from the exponential temperature dependence of thermal excitation.

The experiments are preliminary and only suggest what might be discovered by a thorough application and extension of these methods.

69 pages. \$1.00. MicA 55-196

SUPERCONDUCTIVITY OF A PRECIPITATION HARDENING ALUMINUM ALLOY

(Publication No. 10,525)

Richard Everett Mould, Ph.D.
University of Illinois, 1954

The critical magnetic field as a function of temperature has been measured for a precipitation hardening aluminum alloy in various conditions of heat treatment. The alloy studied contains approximately 1.1% Mg_2Si and the hardening process involves the precipitation of Mg_2Si from a supersaturated solid solution. The purpose of this study was to determine the effect of the lattice distortions produced by the precipitating particles on the superconducting behavior of the aluminum.

In the quenched (supersaturated solid solution) and annealed (fully precipitated) conditions the alloy had a critical field curve closely approximating that of pure aluminum. In the condition of maximum hardness (partially precipitated) the alloy had a critical field curve about eight gauss less than that for pure aluminum. The maximum shift in the critical field curve can be characterized by $\Delta H_0 = -4.93$ gauss and $\Delta T_c = -.055^\circ K$. As calculated from the changes in these constants the electronic specific heat for the hardened alloy in the normal state differed from that of pure aluminum by less than 1%. In conditions of intermediate hardness, the alloy showed a complicated magnetic hysteresis on going through the phase transition between superconducting and normal states with increasing and decreasing magnetic fields. This behavior can be explained, qualitatively by a mechanism which is consistent with known facts about superconductors and about precipitation hardening.

In the condition of maximum hardness, the transitions occurred over a magnetic field interval of only about one gauss and there was little hysteresis. This indicates that the shift in critical field is quite uniform throughout the alloy and that essentially all of the material is affected. It has not been possible to account for the shift in terms of uniform dilation or contraction of the lattice or in terms of changes in the average number of valence electrons per atom. The shift is believed to be caused by short range, highly inhomogeneous strains in the aluminum lattice about each precipitating particle but the basic mechanism is not, as yet, fully understood.

80 pages. \$1.00. MicA 55-197

PHYSICS, ELECTRONICS AND ELECTRICITY

PHOTOELECTRIC EMISSION FROM BARIUM OXIDE

(Publication No. 10,126)

Herbert Reynold Philipp, Ph.D.
University of Missouri, 1954

Supervisor: Albert S. Eisenstein

This work reports the results of studies of photoelectric and thermionic emission from sprayed coatings of BaO in several states of thermionic activity and at different temperatures. A magnetic velocity analyzer was used to determine the energy distribution of the emitted electrons. A study was also made of the enhancement of the photoelectric and thermionic emission by optical irradiation.

The photoelectric yield curves are similar to those observed by other investigators with a rise in yield at a quantum energy of 3.8ev due to exciton-induced emission and a more rapid rise at 5.0ev due to electrons ejected from the filled band. The temperature dependence of the yield at 3.8ev indicates a definite activation energy for dissociation of excitons, $E=0.15$ ev.

Energy distributions indicated that the emission at lower quantum energies arose from impurity levels located photoelectrically about 2.0 and 2.6ev below the vacuum level. The yield at 2ev was related to the thermionic activity of the cathode and also was the energy region responsible for the external exciton-induced photoelectrons.

Measurements of the enhancement of photoelectric emission showed that the shorter enhancing wavelengths produced the greater increases in photoelectric emission, the relative increase being greater at longer observing wavelengths. The enhancement of thermionic emission was found to increase rapidly for enhancing wavelengths below 4500Å.

153 pages. \$1.91. MicA 55-198

PHYSICS, NUCLEAR

THE EFFECT OF THE STRUCTURE OF THE PROTON ON THE HYPERFINE INTERACTION IN HYDROGEN

(Publication No. 10,522)

William Marshall Moellering, Ph.D.
University of Illinois, 1954

The zero-order value of the ground state hyperfine structure in hydrogen (abbreviated h.f.s.) is given by the Fermi formula,

$$\delta E_0 = \frac{4}{3} \langle \vec{\sigma}_p \cdot \vec{\sigma}_e \rangle (g_p \frac{m}{M}) \alpha^2 \text{Ryd} \infty. \quad (1)$$

The object of the present work is to express those effects of the structure of the proton which are of magnitude $\alpha \frac{m}{M} \log \frac{M}{m} \delta E_0$ in terms of the appropriate nucleon matrix elements. It is the specific aim of this calculation to make it possible to determine one of the proton structure effects, viz. that due to the effective magnetic size of the proton, from the precision experimental value of the h.f.s. by evaluating independently the other structural effects that are as large as $\alpha \frac{m}{M} \log \frac{M}{m} \delta E_0$. Outside of the anomalous proton magnetic moment, the only other structure effect of this magnitude results from the polarization of the proton by the electromagnetic forces of the electron.

Including the relativistic, radiative, and proton recoil corrections to δE_0 , it is found that, correct to logarithmic accuracy, the h.f.s. can be expressed as

$$\delta E = \frac{16}{3} \left(\frac{g_p}{g_e} \frac{m}{M} \right) g_e^2 \alpha^2 \text{Ryd} \infty$$

$$\cdot \left\{ 1 - \frac{3m}{M} + \frac{3}{2} \alpha^2 - 1.81 \alpha^2 - R \alpha \frac{m}{M} \log \frac{M}{m} \right. \quad (2)$$

$$\left. - 2 \int \frac{r}{a_0} G(r) d\vec{r} - 1.5 \times 10^{-5} M^2 A \right\}$$

where g_e is the electron magnetic moment in Bohr magnetons. Only the last two terms of (2) are due to proton structure. The first three non-structure terms are well known. The coefficient R of the $\alpha \frac{m}{M} \log \frac{M}{m}$ term is still unknown but appears to be obtainable from work already published. R must of course be found before a comparison with experiment can be made.

The last term in (2) is the proton polarization effect. It is shown that the nucleon parameter A can in principle be evaluated from the angular distribution of the low frequency photon scattering cross section. It is expected that $M^2 A \approx 2$.

The proton size function $G(r)$ in (2) is given by

$$G(r) = \int \frac{d\vec{k}}{(2\pi)^3} \left(\frac{f(k^2) - 2Mg(k^2)}{g_p} \right) e^{i\vec{k} \cdot \vec{r}} \quad (3)$$

$$\int G(r) d\vec{r} = 1$$

where f and g are the two unknown functions in the diagonal matrix elements of the nucleon current density operator,

$$\int_{\mu} N^0 (p'p) = ie (\bar{U}(p'))_1 [\gamma_{\mu} f(\Delta p^2) \quad (4)$$

$$+ \sigma_{\mu\nu} \Delta p_{\nu} g(\Delta p^2)] U(f).$$

With the presently known values of the atomic constants appearing in δE_0 , the experimental value of the h.f.s. can evaluate any proton structure effect that is larger than $2 \times 10^{-5} \delta E_0$ (once R is known). If $G(r)$ is as broad as the meson Compton wave length, the size term in (2) is $\sim 6 \times 10^{-5} \delta E_0$. In any case the h.f.s. experiment can put an upper limit on the spread of the function $G(r)$.

99 pages. \$1.24. MicA 55-199

MESON CONTRIBUTIONS TO NUCLEONIC COMPTON SCATTERING

(Publication No. 10,540)

Harry Moritz Schey, Ph.D.
University of Illinois, 1954

A linear, non-relativistic, pseudoscalar pion-nucleon interaction with pseudovector (gradient) coupling has been used to calculate the cross section for mesonic contributions to the elastic scattering of photons by single protons. An energy cut-off and a pion-nucleon coupling constant determined by Chew from pion-nucleon scattering data have been used in evaluating the results. The calculation has been made in the electric dipole approximation and to lowest order in the coupling constants. The differential cross section has the form $A + B \cos^2 \theta$. For photon energies less than 140 MeV the total cross section is of order of magnitude 10^{-33} cm^2 which is about two orders of magnitude smaller than the results of previous calculations. For photon energies greater than 140 MeV the total cross section increases very rapidly; it attains a value of $1.5 \times 10^{-30} \text{ cm}^2$ at a photon energy of 210 MeV which is the upper limit of the range in which the results are valid.

52 pages. \$1.00. MicA 55-200

THE SPATIAL DISTRIBUTION OF NUCLEAR DISINTEGRATIONS IN PHOTOGRAPHIC EMULSIONS EXPOSED TO COSMIC RAYS

(Publication No. 10,611)

Jay Emery Treat, Jr., Ph.D.
Cornell University, 1954

Previous authors, using photographic emulsions exposed at balloon elevations and emulsions exposed vertically at mountain elevations, have observed that the spatial distribution of stars produced by cosmic rays is not entirely random because the stars show a tendency to be in close proximity to each other more often than would be expected if they were all statistically independent of one another. They found a close pair effect of about 3 star pairs in excess of chance expectation per 1000 stars per 100 micron projected separation interval for star pair separations up to about 500 microns. Above 500 microns the effect, if real, was obscured by statistical fluctuations.

In the present investigation the close pair effect was measured in horizontal C2 emulsions exposed at an elevation of 4300 meters and containing 2533 observed stars. No statistically significant close pair effect was observed, either for plates exposed under an eighth inch lead cover or for plates exposed with no dense cover.

The results of this author were found to be significantly different statistically from those of previous authors for star pair separations between 50 and 500 microns. Under 50 microns the effect for previous authors was still much larger than for the present author and also significantly different from a purely random effect.

A careful study was made of observational bias resulting from star classification methods, scanning methods and efficiency measurements. It was found necessary to take variation in conspicuousness into account in order to achieve a reliable measurement of the over-all detection efficiency of two scans. The efficiency for detecting both single stars and stars in pairs was measured and found to be the same for this investigation. The effect of observational bias was shown to be unimportant in the present investigation and it was shown that observational bias could hardly account for the effect observed by others for pair separations less than 100 microns or even somewhat larger.

Center-fringe scanning was developed in order to minimize scanning efficiency bias by the achievement of a high detection efficiency and by being able to correct reliably for what inefficiency did exist. It was shown that center-fringe scanning achieves optimum scanning speed, maximizes efficiency, decreases fatigue and in addition, enables one to determine scanning efficiency easily by checking events found in the center against events found near the edge of the field in a single scan of the emulsion.

The effects of various mechanisms were calculated for both horizontal and vertical emulsions in terms of the current literature on nuclear disintegrations. These calculated effects were quite consistent with this author's results, but none was found adequate to explain the close pair effect for small separations reported by others. The effect owing to a parent event being formed in the emulsion, emitting one or more asterogen particles and thus causing a neighboring star was found to be an order of magnitude too small. Even when very thick layers of lead were assumed to be adjacent to the emulsion the effect owing to a common parent producing two nearby daughter stars in the emulsion was calculated to be at least a factor of a hundred too small. Consideration of disintegrations involving over twenty shower particles gave no explanation of previous close pair observations. For several previously proposed classes of hypothetical particles, it was shown that either they would not fulfill the requirements for the close pair effect or they would probably have been detected already if they exist.

171 pages. \$2.14. MicA 55-201

PHYSIOLOGY

EFFECT OF DIET AND CHRONIC DEHYDRATION ON RESTING METABOLISM AND METABOLISM OF PASSIVE EXERCISE IN MAN

(Publication No. 10,453)

William Adam Boyd, Ph.D.
University of Illinois, 1954

In order to study the effect of diet and chronic dehydration on the respiratory metabolism in the resting state and during the performance of passive exercise, eight normal young men were placed on 20 nutrient mixtures in which the distribution of calories between protein, carbohydrate, and fat was varied: (1) pure carbohydrate; (2) low carbohydrate-high fat; (3) high protein-high fat; and (4) protein, carbohydrate, and fat in proportions found in customary diets of Americans. The caloric intakes ranged from 0 to 3000 Calories/day. Water was allowed ad libitum for half the subjects and restricted to 900 ml/day for the others. Each two-week experimental period was preceded by one week on a diet adequate in all known nutrients and followed by one week of rehabilitation in which a *luxus* diet was allowed.

A second investigation was made on 99 additional volunteer subjects subsisting on similar nutrient regimens. During the experimental period all of these subjects were exposed to moderate cold stress; half of them performed hard work (marched 12 miles/day) and half engaged in light work (marched 3 miles/day).

In the first study all metabolic measurements were made according to conventional techniques. In the second, a new method was utilized. Since the

latter proved to be technically unreliable in its present stage of development, results of the second study have only been presented summarily.

The following results were obtained.

- (1) A diminished pulmonary output of carbon dioxide on the diets whose composition deviated markedly from the normal diet of the North American population.
- (2) A decreased pulmonary exchange simultaneously with the carbon dioxide retention.
- (3) A lowered oxygen consumption on all low calorie diets, the greatest decrease occurring on the pure carbohydrate diets.
- (4) No effect of chronic dehydration on any of the respiratory measurements.
- (5) The oxygen consumption during the performance of passive exercise was uninfluenced by nutrient regimen.

The hypothesis is offered that the decreased carbon dioxide production on the abnormal regimens is the result of a change in carbon dioxide transport. This hypothesis was supported by some indirect data on urinary excretion of acid metabolites but there was no significant difference in the effects of ketogenic vs. non-ketogenic regimens. As a corollary the lowering of the pulmonary ventilation may be attributed to decreased plasma carbon dioxide level, the effect being mediated through the respiratory center.

The alteration of the nutrient mixture effected the oxygen consumption and carbon dioxide differently. It is concluded that the reduction in both was not simply due to a decreased metabolism in general.

74 pages. \$1.00. MicA 55-202

**SOME EFFECTS OF A PARTIALLY PURIFIED
TOXIN OF MICROCOCCUS AUREUS
ON CHICKEN ERYTHROCYTES**

(Publication No. 10,165)

William D'Aguanno, Ph.D.
Florida State University, 1955

A commercial toxin of Micrococcus pyogenes Var. aureus was partially purified. A respiratory accelerator was separated out by dialysis and acetone precipitation was used to isolate the hemolytic agent. The purified fraction of the toxin had no effect on respiration of chicken erythrocytes. Determinations of lipid content showed no change in the lipid content of the red cell ghosts.

The permeability of chicken red cells to glycerol was not appreciably affected by the toxin as shown by shrinking and swelling measures.

A slight increase in cell Na was effected by the toxin, while cell K showed no marked change.

The toxin had little effect on volume changes of the chicken erythrocyte.

38 pages. \$1.00. MicA 55-203

**INTERRELATIONSHIPS BETWEEN THE KIDNEYS
AND ECCRINE SWEAT GLANDS OF MAN
IN THEIR ELECTROLYTE
AND TOTAL OSMOTIC EXCRETIONS**

(Publication No. 10,505)

Ira Jay Lichten, Ph.D.
University of Illinois, 1954

The formation of human sweat under controlled conditions of sweating was surveyed and compared with the formation of urine with the view in mind of verifying the hypothesis of physiological competition between the sweat glands and kidneys for water and solutes.

Forty-eight one-hour sweating experiments were performed on the same normal male subject exercising at a constant rate on a bicycle ergometer at different hot room temperatures and states of hydration. Rectal temperature, skin temperature, and rate of sweat and urine formation were studied. Blood serum, forearm sweat, and bladder urine were obtained and analysed quantitatively for sodium, chloride, potassium, and total osmols.

The rectal temperatures attained varied directly with the effective temperatures of the room ($R = 0.856$). Skin temperature varied linearly with rectal temperature ($R = 0.936$) and forearm sweat rate varied linearly with skin temperature ($R = 0.856$). The sodium, chloride, and total osmotic concentrations of the sweat were positively correlated with sweat rate ($R = 0.716$, 0.606 , and 0.717 , respectively).

The sweat potassium concentration was negatively correlated with sweat rate ($R = -0.605$). In 36 out of 45 non-dehydration experiments involving low or moderate rates of sweating, the sweat potassium

concentration exceeded the serum potassium concentration.

The sweat was at all times hypotonic to the blood serum in the one subject studied. The osmotic work performed by the sweat glands of the whole body in maintaining this hypotonicity was calculated and found to average 5 gram calories per minute.

No consistent relationship between the composition of the blood serum and the rate of sweating or the composition of the sweat was found.

The data confirmed the existence of competition between the sweat glands and kidneys for water and solutes. This was manifested in negative correlations between urinary and sweat excretions of water, sodium, chloride, and potassium ($R = -0.585$, -0.720 , -0.470 , and -0.659 , respectively).

Acute dehydration of the subject for 48 hours previous to the experiments caused an increase in the threshold for sweating, low skin temperatures and sweat rates in relation to body temperature, and high osmotic concentrations of the sweat in relation to sweat rate.

71 pages. \$1.00. MicA 55-204

**ESTIMATION OF TOTAL BODY WATER
AND STATE OF HYDRATION IN MAN**

(Publication No. 10,530)

Andrew A. Pandazi, Ph.D.
University of Illinois, 1954

In order to test the hypothesis that it is possible to assess an individual's state of hydration by a water loading test, a direct comparison was made between deuterium oxide space and the percentage of a test dose recovered during a water tolerance test. The deuterium oxide was administered by mouth and the urinary deuterium oxide/hydrogen oxide ratio was used to calculate the total body water. The water tolerance test consisted of administering a water load (2% body weight) and measuring the volume of urine produced in the next four hours. A correction was made for basal urine production.

In order to vary the state of hydration, regimens were used in ninety-seven young men for a two-week period, which would impose high or intermediate osmotic loads (fat protein, carbohydrate and inorganic salts in varying proportions) and low osmotic loads (pure carbohydrate or starvation). In addition in fifty of the same subjects water intake was restricted to 900 ml per day. The water tolerance and deuterium oxide tests were conducted on each subject twice, i.e. at the end of a two week normal period, and again at the end of a two week experimental regimen.

The results were as follows: a) During regimens of high osmotic load, with unlimited water, body water remained constant and the recovery of the water test dose averaged 69%. b) During regimens of low osmotic load, with unlimited water, body water decreased an average of 2.2 liters and the recovery of a test dose averaged 55%. c) During regimens of high osmotic load, with limited water, body water

decreased an average of 7 liters and the recovery of a water test dose averaged 15%. d) During regimens of low osmotic load, with limited water, body water decreased an average of 7.2 liters and the recovery of a water test dose averaged 54%.

The general conclusions of the investigation are: a) If the recovery of a water test dose is low, dehydration is present. b) If the recovery of a water test dose is high two possibilities exist: Either the individual is normally hydrated or he is dehydrated and simultaneously osmotically depleted. c) The possibility exists that simultaneous measurements of osmotic excretion together with the water tolerance test would discriminate between a normally hydrated individual, not osmotically depleted, and an individual who is osmotically depleted. The present investigation does not offer the solution to the problem of distinguishing the states of hydration in the osmotically depleted individual. This latter determination would have to be based on the results of repletion with water and salt.

A theoretical treatment of the data is presented based on the concept that the body's total osmotic concentration tends to be guarded against a decrease in dehydration due to limitation of water during regimens of low osmotic load; and to remain constant or increase with limitation of water during a regimen of high osmotic load. It is shown that one would expect a water test dose to be excreted in a case of water deprivation combined with salt deprivation, but to be retained in water deprivation combined with adequate electrolyte intake. The experimental data are consistent with the theoretical concepts.

98 pages. \$1.23. MicA 55-205

AN INTRODUCTION TO ACETATE METABOLISM IN INSECTS: THE FATE OF SULFANILAMIDE AND OF SEVERAL N-ACETYLATED ARYLAMINES IN THE ROACH

(Publication No. 10,614)

Mathias H. J. Weiden, Ph.D.
Cornell University, 1954

To broaden our knowledge of detoxication mechanisms as they occur in insects, attempts were made to demonstrate the *in vivo* acetylative conjugation of sulfanilamide in adults of the American roach, *Periplaneta americana*. Since negative results were obtained, several possible complicating factors were studied, with particular emphasis on the enzymatic deacetylation of N-acetylated arylamines.

The possible influence of competing detoxication mechanisms was ruled out by satisfactory recoveries of injected sulfanilamide. Furthermore, preliminary tests for the presence of the hydroxylated metabolite proved negative.

The rate of excretion of injected sulfanilamide was found to be only moderately rapid (one-half excreted in 4-5 hours) and hence did not seem an important factor in preventing acetylation. The fact that the rate of excretion was slower than that for amaranth (one-half excreted in less than one hour) was interpreted as reflecting the much greater penetration of the insect's tissues by sulfanilamide than by the amaranth, a factor which should favor acetylation.

In view of the foregoing plus the limited hydrolysis of N⁴-acetylsulfanilamide by roach tissues (see below), the observed lack of acetylation of sulfanilamide by this insect is interpreted as resulting chiefly from an inadequacy either in the reaction rate with, or in the quantity of, the enzyme necessary for the transferring of the acetyl group to arylamines, or from both.

Acylase activity (hydrolysis of the amide linkage) against N⁴-acetylsulfanilamide, acetanilide, phenacetine and p-acetamidoazobenzene was demonstrated *in vitro* by tissues of *P. americana*. The calculated rates of hydrolysis in micrograms of substrate per roach per hour were 3-5 for N⁴-acetylsulfanilamide, 4-14 for acetanilide, and 27-71 for p-acetamidoazobenzene. For further *in vitro* studies of the aromatic deacylase of insect tissues, a direct colorimetric method was developed using p-acetamidoazobenzene as substrate. The six species investigated by this method possessed acylase activity. It appears to be widely distributed within the body, since, in the roach, activity was demonstrated by degutted and decapitated insects, by the intestine, by the fat body, and by the legs, which contain no fat body.

Roach acylase is not affected by dialysis, but it is rapidly inactivated by heating at 50°C. Its pH maximum is approximately at neutrality for phosphate-citrate buffers. It is inhibited by acetone, diethyl barbiturate, eserine, methyl ethyl ketone, parathion, thymol, arsenite, fluoride, mercuric chloride, and pyrophosphate. Of these, parathion is the most potent. Inhibition by fluoride is pH dependent.

The identification of several of the above inhibitors as antiesterases (eserine, parathion, fluoride), the esterase property of peptide bond-splitting enzymes such as trypsin and chymotrypsin, and the chemical similarity of N-monosubstituted amides and esters suggest a dual substrate-specificity for insect acylase. The actual relation of this enzyme to insect esterases, however, can only be determined by further experimentation based on purified enzyme preparations.

48 pages. \$1.00. MicA 55-206

POLITICAL SCIENCE

POLITICAL SCIENCE, GENERAL

OFFSHORE OIL POLITICS: A STUDY IN PUBLIC POLICY MAKING

(Publication No. 9034)

Lucius Jefferson Barker, Ph.D.
University of Illinois, 1954

This is a case study of the offshore oil controversy. The purpose of this study is to describe the activity involved in the formation of policy with respect to the oil controversy. Data was primarily drawn from an examination of the written record—congressional hearings and debates; newspapers and other periodicals; proceedings of various nongovernmental organizations such as political parties, the National Association of Attorneys General, Governors Conferences, etc. In addition, questionnaires were sent to the various attorneys general and correspondence was carried on with some of the key men in the controversy.

The offshore oil controversy began more than fifteen years ago, but it was not until the decision in *United States v. California* (332 US 29, 1947) that the issue was brought to fore. Although popularly referred to as the "tidelands" controversy, the tide lands, that is the lands between high and low-water marks, had long been decided by the courts as part of the public lands of the littoral states. The lands with which this study is concerned are the submerged lands lying seaward of the low-water mark, that is, the lands under the marginal sea. The dispute was between those who felt that these lands should be owned by the national government and those who claimed that such lands belonged to the respective states.

Much was involved in the outcome of the controversy. For one thing, at stake were millions of dollars of oil royalties. Some saw the dispute as a battle between an evergrowing national bureaucracy and the innocent states. Others felt that whether oil resources would be properly conserved or would be wastefully exploited depended upon the outcome of the controversy. Some thought that the preservation of high principles such as "states' rights" or the "national welfare" were at stake.

Executive officials of the national government from 1937 through 1952, primarily the President, the Attorney General, and the Secretary of Interior, were the most active among those for national ownership. A majority of the Supreme Court and a minority of the Congress also "supported" national-control. Others in this group included applicants for federal leases under the Mineral Leasing Act of 1920, and a few private organizations such as the Patrons of Husbandry or National Grange, the Congress of Industrial Organizations, etc.

The state-ownership group was composed of a

host of state officials, a majority of the Congress, a minority of the Supreme Court, and a very large number of organizations such as the National Association of Attorneys General. Oil companies with state leases naturally were in this group. After the 1952 election, the executive branch of the national government favored state-ownership.

The battle was fought throughout the entire structure of government---the Congress, the Supreme Court, the Presidency, state legislatures, and so on. It was also fought out within non-governmental forums, such as the National Association of Attorneys General, farm and labor organizations, grocers' associations, educational organizations, etc. The National Association of Attorneys General provided the leadership of the state-ownership group. The issue was also taken to the electorate in the 1948 election, and was of special importance in the 1952 election. After the 1952 election, state-control forces were able to reverse the Court decisions in the "tidelands" cases by passing the Submerged Lands Act of 1953. The passage of this law has not ended the controversy. Several states, including Alabama and Arkansas, have challenged the constitutionality of the new law.

Several conclusions may be drawn about the group which "won" out in the controversy. This group, the state-ownership group, (1) had more private organization support; (2) spent more money; (3) had more newspaper support; (4) had greater representation among state officials---governors, attorneys general, etc.; and (5) had two of the three branches of the national government on its side, the Congress and the Presidency (the executive branch).

The control of the presidency was the determining factor in the outcome of the controversy. Throughout the controversy, the Congress was on one side and the Supreme Court on the other. Neither changed its position. As long as the national-ownership forces were backed by the Supreme Court and the President, the decisions of the Court prevailed, but once the Presidency changed sides, the decisions of the Court were reversed. 258 pages. \$3.23. MicA 55-207

BRITISH GOVERNMENT IN BRITISH COLUMBIA

(Publication No. 10,486)

William Spencer Hardenbergh, Ph.D.
University of Illinois, 1954

The British system of government has been widely adopted in the Commonwealth of Nations, including Canada and its provinces. This study has examined the working of the system in the Canadian province of British Columbia, and has sought to find why this system of government, which developed under very

different circumstances, was adopted and retained in British Columbia.

The British system of government has undergone few important changes in British Columbia, despite sharp differences in nearly all provincial conditions from those of Britain. Each of the chief institutions of the British system--the formal executive, the cabinet, the legislature, and the parties--has been established successfully in British Columbia, and has operated with essential similarity to its prototype in the home islands. The similarity exists not only in the working of the government, but also in a careful mimicry of the procedures and ceremonials of Britain. This replica of the British system operates in a vast province of small and scattered population, which is economically, socially, and culturally different from Great Britain, and is in addition a component of a federation. Some changes have been induced in the system by the conditions of the province. The Executive Council of British Columbia, for example, although in function and political relationships it is closely similar to the British Cabinet, is of much less elaborate organization. The Legislative Assembly's lack of an important committee system is another expression of the greater simplicity permitted by the environment of government in the province. These differences are by no means as significant, however, as the striking similarity of function and relationship among the institutions of British Columbia and Great Britain, despite the sharp dissimilarity of the circumstances in which the two governments operate.

The explanation for the retention of the system lies primarily in two considerations. There is, first, one great and important similarity between British Columbia and Great Britain: the political traditions

developed in Great Britain were transmitted almost intact to British Columbia, and have retained their authority in the province. This transmission was accomplished by the influence of the predominantly British origin of the settlers, and particularly those who entered public affairs in the early days of the province: and by the development of the government of British Columbia under the control of the British Colonial Office. Under such influences, British practice was adopted from the beginning whenever it became appropriate for the developing institutions.

The other explanation for the retention of British government lies in the nature of the system itself. Given the fundamental elements of the British system to begin with, it appears that there were strong tendencies, deriving from the organization of the system, for these elements to maintain themselves, and to evolve along the same lines as government had evolved in Britain. Thus the Lieutenant-Governor, at the beginning of provincial life exercising many of the powers of a colonial governor, was soon forced into a purely formal role, as was the monarch in Britain. Despite the absence of formally organized parties in the Legislative Assembly, the Executive Council was able to rely on steady support from a majority of the Assembly at most times, as could the Cabinet in Britain. The party system itself, beginning from nothing, developed quickly into the two-party system which had existed in the Assembly, though not always in the province, throughout the history of British Columbia. The combination of adherence by the population to the British political traditions and the self-perpetuating tendencies of the system have made it possible for the British system of government to be exported successfully to British Columbia. 330 pages. \$4.13. MicA 55-208

PSYCHOLOGY

PSYCHOLOGY, GENERAL

SOCIAL INTERACTION AND THE SELF CONCEPT

(Publication No. 10,511)

Melvin Manis, Ph.D.
University of Illinois, 1954

This study was based on the theoretical assumption that the individual's self-concept, or the things which he believes about himself, is not essentially different from any other collection of beliefs. Starting from this premise, a series of hypotheses were deduced from Festinger's views on the problem of belief. Among these was the hypothesis that people's self-concepts would tend to be influenced by others' opinions of them. (Such a proposition is, of course, in complete accord with the theories of Cooley and Mead). In addition, it was hypothesized that people would tend to "convince" others of the validity of their self-concepts. Finally, it was predicted that each of these trends would be more marked for two-man groups composed of an individual and his friend, than for two-man groups composed of an individual and a non-friend.

The Ss in this study were 101 male college students all of whom lived in the same dormitory. For experimental purposes, the Ss were divided into groups by pairing adjacent rooms. Most of these rooms housed four men.

Ss described every member of their group, including themselves, on a set of bi-polar rating scales. In addition, each S answered a series of sociometric questions. A test form which included the above-mentioned descriptions and sociometric questions was administered twice, with an interval of six weeks separating the two administrations.

The sociometric data was analyzed so as to select a friend and a non-friend for those of the Ss whose responses fulfilled certain criteria of friendship and "non-friendship."

Analysis of the data showed that:

1. Over a period of time, there was an increase in agreement between an individual's self-description and his friend's description of him.

2. This increase in agreement was more marked for the S and friend pairs than for the S and non-friend pairs.

3. Ss whose self-descriptions were not similar to their friend's description of them tended to change their self-descriptions.

4. Ss whose friends did not describe them as they described themselves were, to a slight extent, more likely to change their self-descriptions than were those whose non-friends did not describe them as they described themselves.

5. Ss self-concepts were influenced by their

friends' opinions of them. That is, they tended to change their self-concepts in such a fashion as to increase the similarity between their self-descriptions and their friends' descriptions of them.

6. Ss self-concepts were more influenced, in the above sense, by their friends' opinions of them than by their non-friends' opinions of them.

7. If an individual's friend did not describe him as he described himself, the friend tended to be unstable in his perception of the individual.

8. Non-friends who did not describe an individual as he had described himself were more likely to be unstable in their perception of him than were friends whose descriptions of him did not agree with his self-description.

9. Ss were unable to influence their friends' perceptions of them. They could not "convince" them that their self-descriptions were valid.

10. Ss were equally unable to influence their friends and their non-friends in the sense which is described above.

The results of this study tended to corroborate those hypotheses which were consonant with the theories of Cooley and Mead. They did not, however, support certain hypotheses derived from Festinger's position, notably those which predicted that Ss would "convince" others of the validity of their self-concepts. As a consequence of these findings, a modification of Festinger's theory, intended to make it more applicable to the problem of the self-concept, was discussed. 85 pages. \$1.06. MicA 55-209

THE ROLE OF SITUATIONAL VARIABLES IN PERCEPTUAL BEHAVIORS CHARACTERISTIC OF AUTHORITARIANS

(Publication No. 10,433)

Theodore Millon, Ph.D.
University of Connecticut, 1954

PROBLEM: The fact that conflicting evidence had been reported regarding the covariance between Authoritarian attitudes and ambiguity-intolerant behaviors, suggested the need for scrutinizing experimental conditions under which investigations were conducted. A review of these studies and of the literature on experimental personality led to the belief that relationships between personality measures and manifest behavior are frequently contingent upon situational factors, specifically that correlations between these variables are best obtained when subjects respond to unstructured stimuli, or when they are ego-involved in their task performances.

The survey led to the further view that behavior

of authoritarians progressed, sequentially, through two relatively discrete stages. First, there was a tendency to replace the vague and unknown with pre-conceived or subjectively structured norms (the tendency to structure, TTS), and secondly, once these "known" and structured anchors were established, authoritarians were unable under modified stimulus conditions to change their norms appropriately (rigidity, R).

SUBJECTS AND PROCEDURE: Individual laboratory sessions were conducted with 60 college students whose standings on the California F scale were known: 30 were experimentally ego-oriented, 30 were task-oriented. Two scores were obtained: (a) the number of trials to form a norm while making judgments of the one-light autokinetic phenomenon, as a measure of TTS, and (b) the per cent of appropriate shift from one's established one-light norm upon the introduction of a second light, as a measure of R.

RESULTS: 1. Overall intercorrelations among F scale scores, TTS and R were significant. However, R scores were not related to TTS, nor to F scale scores in the task-oriented group.

2. Consistently higher correlations were obtained in the ego-oriented group.

3. Ego-oriented subjects manifested significantly greater R than task-oriented subjects.

CONCLUSIONS: 1. Under conditions of ego-involvement individuals tend to display greater consistency and congruence in their behavior.

2. Certain stimuli are capable of threatening the established norms of an individual; the more personally involved an individual is with respect to his norms and values, the more intense and vigilant will be the operation of his defense against stimuli which threaten them.

3. Rigid and structuring behaviors are relatively common perceptual defense mechanisms utilized in response to threatening stimuli.

4 a. In perceptual situations where there are no norms for behavior, or where an individual's personal norms are in conflict with the objective aspects of the stimulus field, perceptual behaviors tend to follow different and predictable courses for subjects differing along the personality dimension of authoritarianism.

b. As long as authoritarians are allowed to operate in a psychologically "peripheral" atmosphere, they are able to adapt their behaviors as well as others. However, when their personal norms are challenged, with a possible corresponding breakthrough of underlying anxieties, their behaviors reveal a sharp increase in rigidity. Thus while the authoritarian characteristic of "generalized mental rigidity" may not be as ubiquitous as it implies, it still indicates considerable comprehensiveness in light of the frequency with which one is exposed to norm-conflicting situations.

c. Quite possibly authoritarians do not differ from other individuals in the way in which they

handle threatening experiences, but do differ in the frequency with which they find their experiences threatening. Whether or not rigidity may be shown to be a favored mechanism of authoritarians, it appears clear that its arousal is contingent upon these threatening situational factors, and cannot be viewed therefore, merely as a characteristic of the individual's psychological make-up. On this basis, the usefulness of the construct "generalized mental rigidity" was questioned, and a more precise intervening variable for conceptualizing the relationship between the antecedent conditions and consequent behaviors of authoritarians suggested: their tendency to experience ego-threat in situations which lack clearcut norms for behavior.

118 pages. \$1.48. MicA 55-210

SOME DEVELOPMENTS IN MULTIDIMENSIONAL SCALING APPLIED TO SEMANTIC RELATIONSHIPS

(Publication No. 10,539)

Thomas Churchill Rowan, Ph.D.
University of Illinois, 1954

Aspects of the generality of certain semantic factors which Osgood has isolated are here investigated. Osgood, using his semantic differential method, studies the meaning to a subject of semantic concepts in terms of the ways in which the subject rates the concepts on a series of seven point scales, the end points of which are defined by bi-polar adjectives. Osgood obtains a distance measure of similarity in meaning between each pair of concepts, and, using samples of both subjects and concepts, he has isolated three dimensions of meaning, evaluation, potency, and activity.

The substantive problem here investigated was whether these same dimensions would appear when a method was used which did not depend on adjectival scales. In order to have a basis for comparing the semantic differential with some method of measuring meaning which would not involve rating concepts on scales, a method here called the similarity method was developed and applied. This method of measuring meaning involves presenting subjects with all possible triads of the concepts being considered and requesting the subjects to indicate which two of the three words in each triad are most similar in meaning. From proportions based on these judgments a distance function was devised, and the concepts were represented geometrically. The "semantic spaces" resulting from this approach were then compared with those resulting from the Osgood approach using the same subjects.

In connection with the investigation of the substantive problem, attention was given to certain problems of multidimensional scaling. It was pointed out that the procedures which have been used by some investigators in this area are based upon theorems from distance geometry. It was shown that distances

derived from some modified forms of traditional scaling procedures can always be considered euclidean and that these procedures should therefore not be used in investigating whether distance in an unknown psychological domain is euclidean. Consequently a new multidimensional distance function which did not superimpose a euclidean model on the data was developed. Procedures were proposed for determining the amount of distortion arising from representing empirically determined distances in euclidean space. In addition to those developments it was pointed out that product moment correlation is not an appropriate technique for assessing the similarity of geometrical configurations. As an alternative, a coefficient based on regression through the origin was suggested.

It was concluded that two of the Osgood factors represent "natural" dimensions of meaning, since they appear when a scale-free method of measuring meaning is used. The remaining factor does not seem to be present in the data collected without scales. It was therefore concluded that this dimension is not a general one, or at least not general enough for it to be revealed using the methods and concepts of this study.

127 pages. \$1.59. MicA 55-211

PSYCHOLOGY, CLINICAL

DIFFERENTIAL EFFECTS OF ANXIETY ON THE USE OF PATTERN AND INTENSITY CUES IN CONCEPT FORMATION TASKS

(Publication No. 10,442)

Louis Clyde Ate, Jr., Ph.D.
University of Illinois, 1954

An "interaction" theory of cerebral dynamics, based on evidence from the fields of clinical neurology, neuroanatomy, physiological psychology and clinical electroencephalography, suggested that states of anxiety should be characterized by increased dependence upon the subcortically mediated, intensive attributes of visual stimuli, and decreased ability to deal with cortically mediated, qualitative attributes of the same stimuli (form and pattern).

This hypothesis was tested in the restricted instance provided by two concept formation tasks (P and I) requiring the use of pattern and intensity cues given on a set of 'concept' cards.

Three groups were studied: thirty "non-anxious" and thirty "anxious" students (University of Illinois Freshmen), as determined by a questionnaire purporting to yield a quantitative measure of "Manifest Anxiety," and twenty-four, "clinically anxious" patients (Veteran's Administration Hospital, Danville, Illinois), with diagnoses indicating "anxiety, without psychosis." Half of the subjects of each group were required to attain the concepts in the order P-I, the

other half in the order I-P. The number of corrections required before concept attainment constituted the basic measure.

The analysis showed that the performances of the clinically "anxious patient" group were in complete agreement with the hypothesis advanced, at a high level of confidence. The "manifestly" anxious student groups, however, though their performances were in the predicted direction, did not exhibit the hypothesized "bias" to a statistically significant degree. The intensity task, I, which had been shown to be much more difficult than the pattern based task, P, in a group of "normally" anxious subjects, was by far the easier task of the two for the clinically anxious patient groups under both orders of task presentation. The reverse was found to be true of the non-anxious student groups. They made a significantly greater number of errors on the I task than on the P task, regardless of the order in which the tasks were offered. The patient groups, in fact, attained the intensity based concept more readily than the non-anxious groups but the differences between them failed to satisfy the stated confidence criterion.

The results of this investigation and the theory that was proposed were related to studies of the Rorschach indices of anxiety and studies of conditioning and nonsense syllable learning in anxious subjects. Some suggested implications that the theory might have for the training and management of the feeble-minded and brain-injured were also presented.

147 pages. \$1.84. MicA 55-212

EFFECTS OF HYPNOTICALLY INDUCED EMOTIONAL STATES, DIFFICULTY OF TASK AND ANXIETY ON PSYCHOMOTOR BEHAVIOR

(Publication No. 10,394)

John Thomas Dickson, Ph.D.
University of Houston, 1955

The present study was concerned with the effect of emotional states on psychomotor behavior. The specific hypotheses tested were that psychomotor performance would be facilitated or inhibited, dependent upon the inter-relationships between: (1) the intensity of the emotion; (2) the difficulty of the task; (3) the nature of the particular emotion; and (4) the anxiety predisposition of the subject.

A group of thirty-six male subjects were divided into high and low anxiety groups on the basis of the Taylor Manifest Anxiety Scale. Three emotional states, fear, anger and interest, were produced by post-hypnotic suggestions.

In the experimental design, six high and six low anxiety subjects were placed under each of the emotional conditions. They were required to perform a letter counting task with three levels of difficulty. Every subject was given each one of the levels of difficulty three separate times; once each time, under the emotional and twice under the non-emotional,

or control, conditions. A counter-balanced design was used to control the effects of the orders of presentation of the various difficulty levels and post-hypnotic suggestions.

The two scores utilized as measures of psychomotor performance were: (1) speed scores, the total number of letters counted in each of the emotional and control conditions; and (2) accuracy scores, the total number of errors made under each of the conditions.

There were two independent criteria of the emotional states. One included autonomic measures of emotional expression, blood pressure, pulse rate, and respiration, which were provided by continuous polygraphic recordings. The second criterion was a card sorting task used as a measure of the experiential aspect of emotional expression.

An analysis of variance design with ranked data was used to test the reliability of differences between: (1) scores on the card sorting task; (2) speed and accuracy scores for the three levels of difficulty under both emotional and control conditions; (3) orders of presentation of tasks and of post-hypnotic suggestions; and (4) interactions between anxiety groups and the three emotional states.

The T-test with ranked data was utilized to find the reliability of differences between: (1) the two control conditions; (2) the emotional and combined control conditions; and (3) the different combinations of the three emotional states.

The raw scores on the physiological measures were converted into standard scores and comparisons were made between the different measures using the T-test.

The results in regard to the three levels of difficulty showed a significant difference under both emotional and control conditions. There was an inverse relationship, with the subjects making more errors and less speed as the level of difficulty increased.

In connection with the counter-balanced design, there were no reliable differences on speed scores due to the order of presentation of post-hypnotic suggestions. There was, however, a significant decrease in the number of errors made at all levels of difficulty when the post-hypnotic suggestion was given on the third task of each set.

The results in relation to the effects of the emotional states on psychomotor performance showed significant differences between emotional and control conditions under fear and interest at the three levels of difficulty for both speed and accuracy scores.

There was an increase in speed and accuracy under the interest condition at all levels of difficulty. An inverse relationship between difficulty level and psychomotor performance was found under the fear condition. This emotional state produced more speed and fewer errors at difficulty Level I, but less speed and more errors at Levels II and III as compared with the control conditions.

Under anger there was a consistent trend for a decrease in both speed and accuracy of performance at all levels of difficulty when compared with the control scores.

On accuracy scores, fear produced significantly

fewer errors than anger at Level I and led to reliably more errors than interest at Level II. Under the interest condition, there were consistently fewer errors, as compared with anger, at all difficulty levels.

In the interactions between the high and low anxiety groups and the emotional states, significant interactions were found only at difficulty Level I for both speed and accuracy scores. Beyond this level, the low anxiety groups, under all conditions, consistently made more speed and fewer errors than the high anxiety groups.

The physiological measures showed significant increases in all measures under the three emotional conditions as compared with the controls. There were also consistent differences between the high and low anxiety groups under all three emotional conditions.

These findings confirm the four hypotheses of the present study. Psychomotor behavior, in terms of a simple letter counting task, is facilitated at all levels of difficulty by the mild emotion of interest. It is also facilitated at the easiest performance level by fear, but becomes disrupted at more difficult levels. Anger appears to disrupt psychomotor behavior at all levels of difficulty. The anxiety predisposition of the subjects effects the performance on the easiest task in a complex manner, but, at more difficult levels, the low anxiety group consistently makes the better performance.

These results were discussed in relationship to the central problem of the effect of emotional states on cognitive processes.

105 pages. \$1.31. MicA 55-213

AN INVESTIGATION OF THE RELATIONSHIP BETWEEN SOME ASPECTS OF PARENT-CHILD INTERPERSONAL LIVING AND OPINIONS IN THE OFFSPRING

(Publication No. 7106)

Ernest Parkes, Ph.D.
New York University, 1953

The research aimed to investigate whether people describing their parents as authoritarian have authoritarian opinions, whether those not doing so, have anti-authoritarian views, and whether sex-religious differences exist in subjects' opinions. The hypotheses were that correlations exist between people's opinions of their parent-child relationships and their social attitudes and that opinions, attitudes and correlations are subject to sex-religious differences.

Instruments used were the California Public Opinion Questionnaire 60A (California Scale) which yielded measures of ethnocentrism (E), authoritarianism (F), politico-economic conservatism (PEC) and fifty descriptions of parent-child relationships (B statements).

The Subjects were 343 white, native American,

New York University, School of Education students. The Christians, 88 males and 60 females, were 63.5 per cent Catholic. The Jews, 67 males and 128 females, issued from parents of whom about 50 per cent hailed from Eastern Europe. Most subjects were less than thirty years old.

The homogeneous subscales of the California Scale were treated by variance analysis, the non-homogeneous by *t* tests. Bi-serial *r* was found between the F scale and each of the B statements, which had been item-analyzed by chi-square. The critical ratio was ascertained for differences among correlations.

Findings, applicable to the present population are: On the B statements, Jewish males differ from Jewish females more than three times as often as Christian males from Christian females; Christian and Jewish females differ from each other two and one-half times more frequently than Jewish from Christian males. Christians are reliably more ethnocentric, authoritarian and conservative than Jews. No significant sex differences occurred here. Interaction between sex and religion was significant only on the PEC scale. Correlations of B statements and F scale yielded 57 positive significant instances in the four groups. Although not significant, 86 correlations were in the expected direction; 57 were negative. There were 34 significant differences among the correlations; eleven between Jewish males and females, six between Christian males and females, one between Jewish and Christian males, six between Christian and Jewish females, ten among the cross-comparisons. Intercorrelations between E, F and PEC scales were significant at the .01 level, differences among them only for E vs. PEC.

Conclusions are: Subjects seeing their parents as authoritarian may develop authoritarian views. Males are more like each other than females in how they view their parents and in how their parent-child relationships may issue in authoritarian views. Christian males and females view their parents more uniformly than Jewish males and females. Christian males and females probably received more uniform parental treatment than Jewish males and females. The difference between how Jewish males and females see their parents may be due to the rebellion of the Jewish male against paternal authority and to the special position of the daughter in the Jewish family. This position makes it possible for her to be critical of parents, yet ally herself with their authority position and to submit to and idealize them but develop authoritarian views to only a limited extent. The continuing influence of small-town Eastern European Jewish family tradition, although not the only possible explanation, seems to fit the statistical facts rather well.

198 pages. \$2.48. MicA 55-214

THE EFFECT OF ANOXIA UPON LEARNING AND REVERSAL OF A POSITION HABIT IN THE WHITE RAT

(Publication No. 10,556)

Milan Tomsovic, Ph.D.
University of Illinois, 1954

This experiment investigated the effects of anoxic anoxia (6 hours at 30,000 feet simulated altitude) upon the acquisition and reversal of a position habit in a single T maze using 23 1/2 hour water deprivation as a drive. Prior to anoxic exposure and training on the above habits, the preference of each animal for either side of the maze was measured. An animal with a "high preference" was arbitrarily designated as one who went at least 10 out of 12 times to one side. The raw data consisted of a distribution of turning preferences, daily weight and water intake, running time, and the total trials and errors for mastery of habit A and its reversal habit B. Microscopic examination of the brains included a qualitative study of vascular pathology and a cell density count made in lamina II of area 10.

Conclusions were as follows:

1. Anoxia did not produce weight changes or alterations in the daily water intake of the experimental animals.
2. The anoxic exposure used was fatal to approximately 25% of the animals. This mortality rate can be considered typical of the animals bred in the home colony.
3. A number of the experimental animals showed transient neurologic signs such as twitching of face muscles and spastic limbs. These persisted for several minutes during return to normal pressure.
4. Anoxia did not produce a disturbance of running time of the experimental group as a whole. At least 3 of the experimental animals, however, showed large increases in running time.
5. The anoxic group required more trials and made more errors in learning habit A and its reversal habit B. These differences lacked statistical significance.
6. Turning preferences in the animals as a group were established at the .001 confidence level.
7. These turning preferences did not facilitate or impede acquisition of the habits in either the control or anoxic group.
8. The brains of the anoxic animals could not be distinguished from controls on the basis of necrosis associated with vascular failure.
9. A cortical cell density count made in lamina II of area 10 showed that the experimental group had a lower mean concentration of cells. The differences, however, were not significant.

95 pages. \$1.19. MicA 55-215

PSYCHOLOGY, EXPERIMENTAL

EXTINCTION AS A FUNCTION OF
FRUSTRATION DRIVE AND
FRUSTRATION STIMULUS

(Publication No. 10,099)

Benjamin Bernstein, Ph.D.
University of Missouri, 1954

Supervisor: Melvin H. Marx

Two experimental situations were employed in this study to test the following general hypotheses concerning frustration: (1) the immediate after-effect of frustration is an increase in level of motivation, and (2) unique internal stimulus components accompany the frustration state.

In the first experimental situation, extinction of an avoidance response was utilized to determine the effect of duration of response blocking on response vigor and resistance to extinction. Four groups of from 18 to 19 Ss each were used. Response blocking times were 0-sec., 2-sec., 4-sec., and 8-sec. As predicted, greater response vigor and greater resistance to extinction occurred for the 2-sec. and 4-sec. groups combined than for the 0-sec. group. The results were interpreted in terms of increase in effective drive due to the occurrence of frustration-produced drive. A reversal was obtained for the 8-sec. group. This was attributed to rapid diminution of secondary drive.

In the second experimental situation, extinction of a running response in a straight alley was employed to test resistance to extinction as a function of short durations of blocking in avoidance extinction. This test occurred on the day immediately following avoidance extinction. Five groups of 15 Ss each were used. These included the 4 groups used in avoidance extinction plus an added control group which had not received the avoidance training. As predicted, greater resistance to extinction occurred for the 2-sec. and 4-sec. groups combined than for the 0-sec. group. No difference was obtained between the 0-sec. group and the control group. A reversal for the 8-sec. group occurred in this test also. The results were attributed to the mediation of increased or continued vigor of goal-directed responses which had become associated with internal stimulus components accompanying the frustration state.

61 pages. \$1.00. MicA 55-216

THE EFFECT OF ELECTRIC SHOCK UPON
DURATION OF ALPHA BLOCK
INDUCED BY VISUAL STIMULI

(Publication No. 10,464)

Jonathan Walkley Cummings, Ph.D.
University of Illinois, 1954

D. B. Lindsley has proposed an activation theory of emotion which is designed to bring emotion into

the list of functions subserved by the diffusely active diencephalic and brain stem reticular system. The disturbance associated with emotion is believed to ascend through that system and to effect a generalized elevation of cortical activity. At the EEG level, this is reflected by alpha blocking and its being replaced by the "arousal pattern."

To the extent that an unpleasant electric shock to the hand is an emotional stimulus, it is capable of eliciting the "arousal pattern" more readily and extensively than is simple sensory stimulation, according to the activation theory. If this is true, it follows that alpha will remain blocked longer in response to a colored light to which an unpleasant shock has been associated than to a neutral colored light.

In the present study, an electric shock to the hand was associated with one of two colored lights while EEG was being recorded. There were 3 groups of 10 male undergraduates each. The groups were treated, respectively, as follows: (1) shock associated to the green light; (2) shock associated to the amber light; (3) no shock. Thirty-two stimuli were presented during the three stages of the experiment (pre-, during, and post-conditioning), in which stages there were respectively 4, 8, and 4 presentations of each light. Perseveration time (PT) of the blocked alpha response was the dependent variable. For each subject, the PT's for each light in each of the three stages were averaged, and the resulting six mean PT's were the subject's scores.

Thus there were 18 cells (10 entries in each cell) arranged in a 3 (groups) X 3 (stages) X 2 (colors) factorial design. An analysis of variance and selected t-tests were performed.

The following results of those analyses were obtained:

1. Only one of the several comparisons which pertained directly to the principal hypothesis was significant (P less than .02). However, trends supportive of that hypothesis were present, since all differences were in the predicted direction.
2. The PT's for the two colors were equal for all three groups in the pre-conditioning stage, thus indicating initial comparability.
3. The only highly significant difference (P less than .01) was that among the stages of the experiment. This reflects an adaptation effect.

The following conclusions were drawn from the study:

1. With an unpleasant electric shock to the hand as the emotional stimulus, the predictions of the activation theory of emotion concerning the effect of such a stimulus upon EEG patterns find some support in the results of this study. The generally small differences are all in the predicted direction.
2. There is a marked adaptation effect of perseveration times.
3. The criteria and method used for scoring the duration of the blocked alpha response appear to be reliable.
4. The frequency distribution of the mean perseveration times is skewed toward the higher values of PT.

5. The intellectual activities of the subjects during the experiment may have affected the results of this study.

94 pages. \$1.18. MicA 55-217

SECONDARY REINFORCING AND
MOTIVATING PROPERTIES OF
STIMULI CONTIGUOUS WITH
SHOCK ONSET AND TERMINATION

(Publication No. 10,113)

Felix E. Goodson, Ph.D.
University of Missouri, 1954

Supervisor: Melvin H. Marx

In order to test the hypothesis that stimuli contiguous to pain (shock) termination will pick up secondary reinforcing properties rats were shocked in a black box and allowed to escape into a white box. It was hypothesized that the shock chamber would pick up motivating properties and the escape chamber reinforcing properties. Ss were then divided into two groups and tested by placing one group in a discrimination situation where it was simultaneously exposed to a box similar to the escape chamber and a neutral box, and the other group in a like discrimination situation where it was simultaneously exposed to a box similar to the shock chamber and a neutral box. In order to balance out preferential factors, two other groups were given identical treatment except that the brightnesses were reversed. The possibility of the generalization of either secondary motivating or reinforcing properties to the neutral chamber was checked by utilizing two control groups and was found not to occur.

The results supported the hypothesis that stimuli contiguous to pain reduction acquire secondary reinforcing properties. The shift in the number of choices of the box similar to the escape chamber between a series of preference trials given prior to training and the same box following training was significant at the .01 level of confidence. It was also found that the shift in choices between preference and test trials was highly significant for the secondary motivation groups (.001 level of confidence). The data also indicated that the curve for the motivation groups was significantly higher (.02 level of confidence) than the curve for the reinforcement groups. Implications of the results were discussed.

57 pages. \$1.00. MicA 55-218

THE APPLICATION OF AN ANALYTICAL
SOLUTION FOR PROPORTIONAL PROFILES
ROTATION TO A BOX PROBLEM AND
TO THE DRIVE STRUCTURE IN RATS

(Publication No. 10,488)

Edgar Marion Haverland, Ph.D.
University of Illinois, 1954

The problems of rotating or transforming factor analytic solutions are reviewed and the rationale and utility of the new proportional profiles method are described. It is pointed out that if the levels of factor profiles can be shown to be responsive to manipulations of the variances of hypothesized factors, great strides will have been made, beyond the methods now available and current, toward establishing the functional reality of factors.

An analytical method is set out, in matrix notation, for rotating pairs of factor matrices by means of orthogonal transformations to the positions where these systematic differences in the level of factor profiles, if present, are apparent.

The method is applied to a "perfect" example; to two physical problems, namely a box problem without experimental error, and one into which simulated experimental error has been introduced; and to two problems involving measures of hunger and thirst behavior in rats.

In the "perfect" example, the method produced the expected results exactly, within rounding error; and in the two box problems the results generally showed differences in the levels of factor profiles though uniform proportionality of loadings was not obtained. A form of Thomson's formula for estimating the effects of selection upon factorial results was discussed as a possible avenue of explanation for the failure of the loadings to be more nearly proportional.

In the problems involving hunger and thirst drives in rats, the proportional profiles method failed to yield the expected results. However, simple structure rotations in these problems yielded fairly definite hunger and thirst factors.

117 pages. \$1.46. MicA 55-219

A QUANTITATIVE STUDY OF LEARNING
IN THE RUNWAY AS A FUNCTION OF
HOURS OF FOOD DEPRIVATION

(Publication No. 10,117)

Shinkuro Iwahara, Ph.D.
University of Missouri, 1954

Supervisor: Melvin H. Marx

The present study was designed to test Hull's theory of learning as a function of hours of food deprivation (h). He postulated that the functional relationship between drive in the $S^E R$ scale and h is concave from about $h = 3$ to $h = 48$. Secondly, he

stated that $S^E R$ is positively related to drive strength but $S^H R$ is not. These two learning concepts are mathematically defined as:

$$S^E R = M(1 - 10^{-iN})$$

$$S^H R = 1 - 10^{-iN}$$

In order to test these two postulates, three groups of white rats were given one trial per day for 20 days in a simple straight runway with a reinforcement of a .060 gram pellet. The groups differed only in terms of h (23 hrs., 12 hrs. and 2.5 hrs.) at the time of training. Three time measures were observed: starting time, running time and total time. To determine drive strength in $S^E R$, superthreshold $S^E R$ values were computed for each group as a function of the number of reinforcements, using Hull's quantification method. A fitted equation expressing the relationship between $S^E R$ and the number of reinforcements was obtained by the least-squares method.

The results indicated that the drive curve in $S^E R$ as a function of h was either linear or convex and disagreed with Hull's. The discrepancy may be explained partly by the fact that the drive value was directly computed for the present data, while his was indirectly obtained through intervention of several other variables such as the number of trials to extinction, the number of reinforcements and the absolute threshold.

The second postulate was tested using four indices of learning rate (direct time measures, acquisition scores, and two $S^H R$ measures). The learning rate which determines $S^H R$, was defined, following Hull, in terms of the speed to reach the limit of learning or acquisition.

A positive relationship was obtained between h and learning rate in terms of the direct time measures using the median for each trial but the reverse was true for the rest of the measures. This difference may be due to the fact that the response variation was a joint function of trials and drive. At any rate, the learning rate and thus $S^H R$ was not independent of drive for most of the measures used.

When the three time measures were compared with each other, the largest drive values were obtained for the running time and the least for the starting time. Moreover, the learning rate was not the same for the three measures when the drive variable was kept constant. The data based upon the starting time showed the lowest learning rate for most of the cases.

This fact indicated that these three kinds of data (starting times, running times and total times) were not entirely homogeneous or that they did not measure exactly the same variable. However, relatively high correlations (.402 or higher) were found among the three measures.

In conclusion, the present results were not consistent with Hull's theory of hunger drive and his definition of $S^H R$ in that the drive strength curve in $S^E R$ was either linear or convex in contrast with Hull's concave curve from $h = 3$ to $h = 48$ and also in that $S^H R$ was found to be dependent upon h in contradiction to his theory.

95 pages. \$1.19. MicA 55-220

ATTITUDE SHIFT AS RELATED TO PALMAR SWEATING IN GROUP DISCUSSION

(Publication No. 10,503)

Edwin David Lawson, Ph.D.
University of Illinois, 1954

This investigation undertook to determine whether attitude change which occurred during group discussion was accompanied by palmar sweat increase. Increase in palmar sweat was predicted on the basis that anxiety would be aroused by a minority position in a group discussion situation. Subjects were undergraduate male students at the University of Buffalo.

Procedure. This consisted of four main parts:

1. pre-test in which Ss and controls were selected,
 2. discussion session in which E attempted to bring about a change in attitude,
 3. post-test in class on the two original scales,
 4. post-experimental interview with each S by E in which S's perception of the experiment was investigated.
- Two pre-test scales of nationalism were administered, a Flag Scale in which judgments were made of various flags, and a Verbal Scale consisting of 28 Likert-type items. Individuals who fell into extreme categories on both scales were selected. Forty internationalists and 40 nationalists were chosen. Subjects were paired by matching scores on the two scales. One subject from each pair was the experimental S, the other his control.

A discussion-group competition was announced in which a cash prize would be offered for the best group performance. Volunteers were solicited. Actually, only those who had been previously selected as Ss (unknown to them) were invited to participate. Each S found himself in a group where the majority opposed his point of view. Thus if a S was a nationalist, the instructed majority was internationalist. This was reversed for the internationalists. Generally two naive Ss of the same score category were used, e.g., two nationalists vs. an instructed majority of 6-8 nationalists. Palmar sweat measures were taken at the beginning and end of the discussion session. Post-test was given in class the next day. Personal interviews were given about a week after the post-test.

Results. Attitude shift was successfully brought about with the nationalist group in the predicted direction (toward internationalism), not so successfully with the internationalist group. Palmar sweat decrease was found in both groups rather than the predicted increase. A relationship was clearly suggested between attitude shift and palmar sweat fluctuation (sweat changes without regard to direction). This was not true of the internationalists. In both groups Ss who shifted on both attitude scales tended to have greater palmar sweat fluctuation. It was necessary to explain differences in results of the two E groups. Evidence indicated that the two E groups came from different populations on measures other than attitude. The two E groups differed on the palmar sweat measures in terms of initial level, decrease, and fluctuation and were significantly different on the manifest anxiety (Taylor scores).

Interviews with Ss indicated differences in the way the two groups perceived the situation.

Conclusion. Level of anxiety may be an important factor in the positive relationship found between attitude shift and palmar sweat fluctuation in the more anxious group (nationalist). Suggestion is also made that the nationalist group may be more susceptible to the type of social suggestion used in the experimental procedure. Results are interpreted as supporting the original hypothesis that attitudes are acquired in a manner suggested by the two-factor two-component theory since the evidence demonstrates that autonomic involvement is related to attitude shift.

138 pages. \$1.73. MicA 55-221

THE ROLE OF PROPRIOCEPTIVE CUES IN CONDITIONING

(Publication No. 10,435)

Louis Radner, Ph.D.

University of Connecticut, 1954

The purpose of this research was to investigate some of the properties and sources of proprioceptive stimulation. Massed eyelid conditioning trials were given to eight groups of subjects. Five of the groups were used to investigate the effects of kinesthetic cues provided by voluntary hand movements. Subjects in the pre-tap and tap groups were required to tap in time to a buzzer CS during acquisition and extinction. The pre-tap group was given an opportunity to practice the tapping cycle prior to acquisition while the tap group was not given this opportunity. In a third group (up-tap), the time interval between the kinesthetic cues and the external CS and US was varied by having the subjects lift their finger in time to the buzzer. A further variation in the timing of the movement cycle was attempted with subjects (puff-tap group) who tapped in time with the US. A fifth group (no-tap) was used as a control group and made no consistent movements during either acquisition or extinction.

Conditioning occurred rapidly in all groups but habit strength tended to be greatest in the groups (tap, pre-tap, up-tap) in which consistent kinesthetic cues were present before the onset of the US. Proprioceptive control over the temporal position of response was demonstrated by the heavy concentration of CR's around the beat-stroke of the tapping cycle. Pre-acquisition tapping practice was not a necessity for such response clustering. The concentration of response occurred only when the beat-stroke was simultaneous with the external CS, indicating that the critical stimulus for response control was a compound consisting of a particular kinesthetic stimulus and an external cue.

Three groups of subjects were used to investigate the effects of feedback from overt and covert speech. In one group (verbal control) no attempt was made to introduce consistent speech feedback during

acquisition and extinction. The second group (overb) was required to repeat a nonsense syllable on each trial. A third group (coverb) silently counted the occurrences of the external CS. The overb group tended to exhibit stronger conditioning than either the coverb or verbal control group. Overtly speaking and silently counting resulted in very similar temporal concentrations of CR's. The results are interpreted as confirmatory evidence both for the motor theory of thought and for those theoretical formulations assigning specific cue value to the muscle feedback from overt and covert speech.

105 pages. \$1.31. MicA 55-222

RESPONSE STEREOTYPY AND RETROACTIVE INHIBITION

(Publication No. 10,541)

Hans Schmidt, Jr., Ph.D.

University of Illinois, 1954

Two hypotheses were proposed for investigation.

1) Brain injured rats tend to stereotype responses more than do intact rats. 2) Brain injured rats are more susceptible to retroactive inhibition than normal rats.

Brain injured and normal rats learned a black-white discrimination to the criterion of ten consecutive errorless trials. Then half the normal animals and half the brain injured animals rested for a week, while the other half of the animals learned a position habit in the presence of the same stimuli of original learning. The position habit was learned to a criterion of ten consecutive errorless trials also. One week following the last acquisition trial, the animals relearned the original habit to the criterion of ten consecutive errorless trials. This experiment was repeated with the difference that there was feeding pretraining in a neutral situation in the replicated experiment.

Retroactive inhibition was produced in the normal and brain injured rats. The brain injured rats gave no evidence of being more susceptible to retroactive inhibition than the normal rats though the former did stereotype responses to a greater extent than did the latter.

Pretraining had an effect upon the brain injured rats though not on the normal rats. Following pretraining, the brain injured rats retained the habit to a greater extent and showed less stereotypy than without pretraining. This effect appeared to be attributable to a decrease of emotionality. It was suggested that the emotional condition of the brain injured animals without pretraining resulted in the laying down of a faulty trace during acquisition which explains the poor retention of those animals.

48 pages. \$1.00. MicA 55-223

SOCIAL PSYCHOLOGY

A STUDY OF MEDIATION THROUGH AN ANALYSIS OF THE BACKGROUND OF DISPUTES AND THE ACTIVITIES OF THE MEDIATOR

(Publication No. 10,593)

Henry Adolf Landsberger, Ph.D.
Cornell University, 1954

The purpose of this thesis was to further understanding of the mediation of labor disputes. This was done, first, by examining the effect on the mediation process of the circumstances surrounding the growth of the dispute prior to mediation, and the effect on the mediation process of differences in these circumstances. Second, the mediation process was studied by examining the behavior of the mediator in terms of the functions he has to fulfill, and the limits set on his behavior.

The data for the study consisted of the transcribed recordings of a total of twelve mediation cases from the city office of a state mediation service. Four mediators were involved in these twelve cases. All cases were settled or were adjourned *sine die* at the end of the recorded sessions. The cases all came from small companies, this being the type of case most frequently handled by this agency, although not the most important in terms of aggregate number of workers affected.

The data were analyzed in systematic qualitative manner as well as by a quantification of the recorded material. R. F. Bales' Interaction Process Analysis was employed for quantitative treatment, and the cases were ranked in terms of success of outcome. A specially constructed Sentence Completion Test was also employed.

Qualitative examination of the twelve cases showed that the disputes with which mediators dealt arose not only because of external conditions to which the two sides could not or would not adjust, as had been maintained in a previous study of mediation. Rather, the many-faceted nature of the relationship between the parties seemed to play some part, often a major one, in determining whether possible demands and refusals were translated into actual demands and refusals, what type of issue was in dispute, the ease and possibly also the likelihood of settlement, etc. Moreover, the nature of the parties' relationship seemed to be actually capable of causing external-type problems, as well as being itself affected by pressures from outside.

Qualitative examination also indicated that the presence of relationship problems exerted a profound effect on the negotiating process which follows the appearance of issues-in-dispute and is supposedly designed to settle these issues.

The content of these relationship problems, very similar from case to case, seemed (in part) frequently

to be the employer's vacillation between a denial of all responsibility for his employees on the one hand, and on the other, his desire to maintain a paternalistic semi-benevolent relationship with them. Mediators, usually aware of the problem, and sometimes aided by the employer's desire for help, nevertheless seemed to feel neither desirous nor empowered to do much about such relationship problems, nor could this realistically be expected of them.

Quantitative analysis, comparing participants' behavior during the mediation sessions with that of members of other groups for whom statistical norms exist, indicated amongst other things that these mediation sessions are generally successful in resolving specific problems. The rather high occurrence of expressions of positive feelings between the parties might have been in part responsible for such a high level of success. Related to this was the finding that the more intense hostile feelings were at the beginning of a session, the poorer were the chances for success at the end. There were quantitative indications that these mediation sessions served a cathartic function where relationship problems existed, but probably did not succeed in resolving them.

The mediator's behavior, in quantitative terms, was seen to be one of providing the group with both task-leadership and with leadership in the form of imparting a more positive air to the proceedings: increasingly so in those sessions which seemed to call most for these contributions. But the mediator's status was seen to be limited, and did not allow him unlimited opportunity to exercise these functions directly. Various means for circumventing these limitations were pointed out. Note was made of individual differences in mediator behavior and differences in the parties' reactions to mediators.

The quantitative description of the mediator's role led to a qualitative analysis (based on the literature on mediation) of the functions and limitations of the mediator's role and the frequently delicate and stressful relationship which he must maintain with the parties. Results from the Sentence Completion Test indicated that in fact these objectively stressful factors did not result in subjective feelings of role-conflict for the mediators in the agency here studied. The thesis concluded with recommendations for further research into the matter of the mediator's role and for study needed in regard to personality differences between mediators.

295 pages. \$ 3.69. MicA 55-224

**EXPLORATIONS IN RURAL COMMUNITY
HEALTH, WITH PARTICULAR REFERENCE
TO PSYCHO-PHYSIOLOGICAL SYMPTOMS**

(Publication No. 10,595)

Allister Miles Macmillan, Ph.D.
Cornell University, 1954

In the context of the Stirling County Study on the Epidemiology of Mental Disorder in a rural maritime community, the problem arose of obtaining a county-wide estimate of the proportion of adults with psychoneurotic symptoms. The scarcity of suitable measuring instruments, (particularly those standardized on rural populations), led to an attempt to develop and standardize such a device.

A selected set of seventy-five health questions, designed to reveal psychoneurotic illness but limited to "non-offensive" queries, (mainly of a psycho-physiological nature), was administered to a sample of both rural-community adults and a population which had been diagnosed by psychiatrists. The latter consisted partly of in-patients and partly of individuals attending out-patient services. In order to have some check on validity, a psychiatrist made an independent diagnostic estimate of sixty-four of the community adults who had previously received the questionnaire. This was done by bringing the psychiatrist into the rural community and providing him with a mobile office in a trailer.

Analysis of the data reveals that the responses of 559 white, rural-community adults, when compared to the responses of 78 psychoneurotic patients from a similar cultural milieu, showed forty of the questions as able to distinguish between the two groups at the 1% level of confidence by Chi-Square test-sexes and ages combined. However, no combination of ten or more of the 75 items satisfied the scaling criteria advocated by Guttman for uni-dimensionality, in contrast to the Army social-psychological screening experiences reported in Volume IV of *Studies in Social Psychology in World War II*, by Stouffer, et al, 1950. This finding applies to several sub-population breakdowns of age, sex, and different diagnostic categories. Similarly, no combination of items, as arranged by a panel of psychiatrists with respect to certain recognized psychological variables, such as anxiety, were found to satisfy the above scaling criteria.

The forty highly discriminating items were re-appraised statistically across several such cultural areas and twenty were found to differentiate between all sub-cultural areas and the psychoneurotic population. These "Universal" items were weighted individually by means of an adapted discriminant function analysis resulting in an index which appears to discriminate between the community and psychoneurotic groups, and which agrees closely with the psychiatrists' check of the 64 community adults. In addition, the kinds of field notations made by the interviewers bore a close relationship to the subsequent scores of the index. The results suggest that for this population, the index differentiates sharply between "well" community males and

diagnosed neurotic males, while the discriminating power for the female groups is somewhat less effective, although still sufficient to suggest the desirability of further attempts at analytic refinement.

Additional work is in process aimed at singling out the sex-linked items for re-weighting by the discriminant function technique so that separate indices may be obtained for males and females. In addition, the data has been subjected to latent structure analysis during which groupings of test-items, previously selected by psychiatrists have been found to fit more than twelve latent dichotomies.

501 pages. \$6.26. MicA 55-225

**RELATIONSHIPS BETWEEN PARENTS
AND SONS ON AUTHORITARIANISM**

(Publication No. 10,437)

Andrew Harry Souerwine, Ph.D.
University of Connecticut, 1954

The F scale, which supposedly measures authoritarianism, was administered to 53 college freshmen and their parents. Comparisons were made among the three groups on the basis of total F scale scores and scores on each of the items. Cluster analyses were also completed for the three groups and comparisons made of the clusters found. The findings are:

1. The parents were found to be significantly higher on total F scale scores than their sons. No significant differences were found between the means of the parents.

2. When the parent populations were categorized into those with a high school education and under and those with more than a high school education, it was found that the lower education group had a higher mean F scale score than the higher group. These data were used to suggest that the F scale differences may be related to differences in education between the groups and not solely to differences in personality variables.

3. Parents were also combined into pairs on the basis of their education (high-high, low-low, high-low, low-high). Sons of these combinations were then compared on total F scale score. It was found that sons of the high-high parent combination had significantly lower scores on the F scale than those of the low-low parent combination.

4. Using total F scale scores for comparison, sons were found to be significantly related to mothers but not to fathers. This was interpreted in terms of the cultural orientation of the American family.

5. Parents' scores on the F scale were tabulated as being high (above the median) or low (below the median). Parents were then paired on the basis of this variable and sons of these various parent combinations were compared on total F scale scores. While the interaction ratio was not significant, it was in the direction of showing that either fathers or

mothers contributed more to the variance of the sons' scores when the other parent was low than when the other parent was high. Furthermore, the source of variation coming from the mothers was highly significant, while that from the fathers was not.

6. There is a wide range of content in the items on which parents and sons differ significantly on agreement or disagreement. It was therefore suggested that the differences in scores between the groups are not a function of a few specific items.

7. A cluster analysis of the F scale items for the three groups demonstrated (1) that the F scale is not unidimensional, (2) that there are some clusters which were similar for two of the groups but not for all three, and (3) that some of the items in the F scale fall into clusters with different item content for each of the groups. This suggests that items have different meanings for different groups of individuals and that comparisons between groups on individual item responses are therefore limited in meaningfulness.

8. In those cases where there were clusters of similar item content for two groups, the groups were compared on the basis of the total scores on these clusters. The correlations between parents and sons were found to be positive but insignificant, while those between parents were found to be positive and significant.

9. The fact that there were no significant relationships between parents and sons on cluster scores was interpreted as meaning that what is measured by the F scale is not highly transmitted from parents to sons. It was suggested that this low correlation may be in part due to the differences in social orientation of the parents and sons.

10. Consideration of the data points to the suggestions (1) that the F scale is measuring not only personality variables but also attitudes and opinions, and (2) that the F scale be subjected to a more elaborate analysis involving a design to determine exactly what is being measured.

86 pages. \$1.08. MicA 55-226

SOCIOLOGY

SOCIOLOGY, GENERAL

A SOCIOLOGICAL EVALUATION OF SOME URBAN PLANNING PROGRAMS

(Publication No. 10,462)

Robert Elson Corley, Ph.D.
University of Illinois, 1954

Two current trends in city planning, the garden-city movement and the neighborhood-unit program are examined for their sociological implications. Both movements approach the solution to urban problems from different perspectives, yet each embodies some of the same fundamental notions about the nature and origin of these problems. In the end they provide similar solutions in spite of superficial dissimilarities in plan.

Both programs seem to imply that the basic difficulty with contemporary urban life stems from the anonymity, impersonality and the accompanying insecurity with which the urban dweller is faced. As a result the attempt is made to restore the primary-group as the fundamental relationship system in the city. In the garden-city plan this is to be accomplished by building new, small, independent cities whose character is preserved by an encircling green belt that is designed to control and limit growth as well as to bring about the "marriage of town and country" much after the manner of the 19th century rural community. In the neighborhood-unit plan it is thought that this would result if one could provide self-sufficient, convenient and well-planned neighborhoods which can be serviced by an elementary

school of "ideal" size. This emphasis upon the small community and the primary group resulted in plans which were designed to encourage and almost require such associations on a "neighborhood" basis.

Some actual planned projects were studied for the purpose of discovering some of the difficulties encountered in their implementation. It was assumed that these difficulties would give a clue as to whether such purposes on the part of planners could be carried out within the context of a modern, industrialized institutional order. Neighborhood plans in large cities as well as the Greenbelt towns and Park Forest, Illinois, provided the specific data for the study.

An examination of this data led to the conclusion that such plans, insofar as they attempt to rebuild the city after the 19th century "primary-type" community were unrealistic in view of the nature of modern social order. Even where physical planning was designed specifically to promote intimacies on a neighborhood level, residents still made approximately half their friendships across these artificial boundaries. The developing economic and other institutional areas of life require a type of interdependent relationship system which cannot be localized within any one city or neighborhood regardless of the type of physical planning. In the specific projects studied it was felt that greater planning success resulted in just those instances where the original plan was modified to the extent that the larger institutional order was recognized and dealt with. Rigid planning which attempts to isolate small cities or neighborhoods is doomed to failure because it does not give adequate consideration to the nature

of an industrialized social order and the fact of social change. It tends to become unflexible and static.

City planning must then emphasize institutional planning and develop physical plans which will implement the functioning of this larger institutional order. It is only in this sense that planning can provide the means whereby individuals and groups can function at all in an industrial civilization.

242 pages. \$3.03. MicA 55-227

SOCIAL STRATIFICATION AND THE EDUCATIVE PROCESS: AN EXPERIMENTAL STUDY IN PRE-SERVICE TEACHER EDUCATION

(Publication No. 6271)

Theodore I. Lenn, Ph.D.
New York University, 1953

In several studies of social stratification and the educative process, including this one, the distribution of rewards and punishments proved to be biased in favor of the higher social classes.

The hypothesis of this investigation raised the following question:

If teacher trainees are given systematic training in the identification of social-class status of pupils, will this new skill and new understanding of social class in educational institutions bring about significant change in the student teacher's relations to his classroom pupils?

Preliminary attention was given to the historical background of social class. Definitive treatment was given to a review of the more recent literature that has been concerned with the impingement of social class on the mass educative process.

The procedure was of projected "before-after" design utilizing control groups. Two teacher trainee groups, of eleven each, were equated. One group was exposed to a sociology course emphasizing systematic social-class analysis. This variable was withheld from the control group. The dissertation has described in detail how the variable was introduced. Evidence, based on "before-after" measurements, has been presented to show that the trainees who took the course achieved understanding and skills commensurate with stated objectives.

The two trainee groups were then placed in comparable practice-teaching situations (22 matched classrooms, grade-range 4 through 12). At the end of the practice-teaching, data were collected pertaining to the distribution of rewards and punishments¹ to the respective pupils of each trainee group. Chi-square was selected to test the significance of the relationship between the pupils' social-class index² and their reward/punishment distribution. This relationship was then measured by contingency coefficients (corrected). Distributions of the regular teachers, just prior to the practice-teaching term, served as the "before" measurements. Distributions

from the experimental and control trainees served as "after" measurements.

The testing of the hypothesis, involving at the same time confirmation of the aforementioned X^2 and C measurements, was focused on the significance of the difference of the differences between the experimental trainee group and the control trainee group. The small-sample "t" test for related measures was applied to these "before-after" data. This meant that "before-after" change between the experimental and control trainees was measured on the basis of their reward/punishment distributions, by class index, to their respective pupil groups.

Primary findings:

1. Evidence was produced (by controlled experimentation) to show that after systematic training in social-class analysis was introduced to a group of teacher trainees, these trainees, as subsequent practice-teachers distributed classroom rewards and punishments in a significantly more proportionate manner, in terms of social-class index of the recipients, as measured against the previous distributions of the regular teachers, and as measured against the distributions of a control trainee counterpart, the latter having demonstrated no significant "before-after" change. Significance was below the 0.001 level of probability.

Secondary findings:

1. Previous studies, notably of the Chicago School, have demonstrated that higher social-class levels always secure higher I. Q. scores. The total sample (N=547) of the present study confirms this situation.
2. Confirming Hollingshead and the Abrahamson findings, the present study has demonstrated that the higher social classes tended to receive more than their proportionate share of classroom rewards and less than their proportionate share of punishments. The reverse was true for the lower social-class pupils.
3. The present study, after having stratified another sample (N=547) of American society, has found the social-class pattern to be very similar to Yankee City, Jonesville, and other investigations.

This investigation thus has confirmed previous evidences and has introduced some new evidence of bias in the educative process. It has demonstrated one operational technique for improving the situation, and it has drawn some implications for further research and action. Some changes in the present preparation of teachers seem to be strongly in order.

608 pages. \$7.60. Mic 55-8

1. Academic grades, classroom favors (including prizes and awards) and punishments, offices held by the pupils, participation in extracurricular activities, and social acceptance scores.
2. The investigator employed the Warner I.S.C.

scale in stratifying the pupils (N=251) taught by the experimental trainees, and the pupils (N=286) taught by the control trainees.

THE SOCIAL AND ECONOMIC ASPECTS OF CHRONIC ILLNESS IN RURAL MISSOURI

(Publication No. 10,122)

John Boyd Mitchell, Ph.D.
University of Missouri, 1954

The purpose of this study was to examine the morbidity experience of the farm population in two homogeneous areas of Missouri in order to determine the amount of disabling illness contributed by the chronically ill, the prevalence of chronic conditions as expressed by persons continually ill for three months or longer, factors associated with differential reporting of chronic morbidity, and variations in the chronic morbidity rates of the two populations.

The morbidity experience of these two populations was examined in reference to age, sex, education, occupation, socio-economic status, and level-of-living. Additional analyses considered the use of professional health services and variations in use of these services by the above criteria. These hypotheses were examined:

1. Chronic morbidity rates decline as educational attainment of respondents increases.
2. Disabling chronic illness and prevalence of chronic conditions decline as the socio-economic score increases.
3. Persons living in a more favorable situation as expressed by township level-of-living indexes will report a smaller amount of chronic illness than those living in townships with a lower index.
4. Individuals of more advanced formal schooling will report relatively more physician calls for days of chronic disability than those with less education.
5. Use of physician services for chronic disability increases as the socio-economic score increases.
6. Differential use of physician services for days of chronic morbidity will be reported by persons living in townships with varying level-of-living indexes.
7. A population in an area with a given number of hospitals and hospital beds will make greater use of hospital facilities in relation to total days of disability reported than a population with fewer facilities.

The incidence data and use of physician services cast doubt on hypotheses one through six. The rates fluctuated in an erratic manner. No significant differences in prevalence rates were encountered within the areas and these findings cast doubt on

hypotheses one through three. The data on use of hospital facilities substantiate hypothesis number seven.

One may conclude that the socio-cultural setting in Area II was more conducive to the incidence and prevalence of chronic morbidity than the setting in Area I. Significant differences in morbidity experience were found when the two areas were compared. However, the chronic illness situation was of serious magnitude in both areas. The population in Area I made greater use of medical services. Within areas the populations were homogeneous in the reporting of chronic conditions. The other data would indicate that educational attainment, socio-economic scores, and level-of-living indexes are ineffective in differentiating groups within homogeneous rural social areas as to incidence of chronic illness and use of physician services.

317 pages. \$3.96. MicA 55-228

FACTORS RELATED TO THE FORMAL SOCIAL PARTICIPATION OF TWENTY-SIX SELECTED RURAL PERSONS - WITH CASE STUDIES

(Publication No. 10,602)

Louis Albert Ploch, Ph.D.
Cornell University, 1954

Chairman: William W. Reeder

This study was exploratory in nature. An attempt was made to identify and isolate the relationships among social and social psychological factors contributing to the formal social participation of 26 male household heads in an upstate New York school district community.

The research was guided by a theoretical conception of social process as being composed of motivated actors interacting in a social structure comprised of institutionalized roles, statuses, and social sanctions.

To select the informants data on file in the Department of Rural Sociology, Cornell University, for the community concerned were utilized. The selected informants represented four model types which were termed the participation categories:

- a. The high-highs - persons of relatively high status who were active formal participants.
- b. The low-highs - persons of relatively low status who were active formal participants.
- c. The high-lows - persons of relatively high status who were inactive participants in formal activities.
- d. The low-lows - persons of relatively low status who were inactive participants in formal activities.

Both open-ended, relatively unstructured interviewing, as well as the regular schedule method were employed to collect the data. Each respondent was interviewed three times by each method. The interviews were centered about the informants'

relationships, attitudes, and interests toward his community, occupation, and family. Detailed information was obtained on the informants' formal, semi-formal, and informal participation.

Findings from the analysis of the participation categories:

1. The respondents' families of orientation tended to serve as role models for their own participation; participation patterns learned as youths tended to continue into adulthood. Family encouragement to participate as a youth was highly related to degree of participation as an adult.
2. Compared to the inactive participants the active participants (high-highs and low-highs) (1) had more associations, both formal and informal, with their wives, (2) verbalized (and behaviorally demonstrated) a greater interest in, and a knowledge of, the community, (3) held larger areal conceptions of the community (areal conceptions were independent of place of residence), and (4) exhibited less anomic tendencies.
3. The polar extremes (high-highs and low-lows) tended to perceive the existence of stratification variables to a greater degree than did the informants of the intermediate groups.
4. There were qualitative as well as quantitative differences in the formal social participation of the informants of the participation categories as groups.
5. The validity of the participation categories as meaningful entities was partially established by the fact that a series of community raters placed the informants in the status hierarchy of the community and identified their degree of formal participation as being approximately the same as indicated by their original placing in the participation categories. The ratings were highly correlated with objective indices of both prestige and formal participation.

Eight case studies, two from each of the four participation categories, were presented; they tended to confirm the relationships found to exist in the general analysis. Tentative hypotheses derivable from the case studies are: (1) the individual is attracted to those organizations which epitomize his own value orientations, (2) upwardly mobile persons are accorded positions of organizational leadership, (3) high involvement in organizations is associated with high informal participation, (4) disassociation from community activities is not necessarily related to personal disorganization.

Implications from the research were that future social participation studies would profit from (1) being cast in a dynamic framework, (2) employing reference group theory and content analysis, (3) investigating the relationship of personality and social participation, and (4) by being interdisciplinary in approach.

506 pages. \$6.33. MicA 55-229

THE STRUCTURE AND DEVELOPMENT OF SOCIAL COHESION

(Publication No. 10,608)

George Achilles Theodorson, Ph.D.
Cornell University, 1954

This study is an attempt to devise an adequate theoretical formulation in the study of small group cohesiveness. A conceptual framework is presented in terms of five analytical elements. The five analytical elements, which are called the structure of cohesiveness, are an adaptation of the "pattern variables" in the theoretical system of Talcott Parsons. These analytical elements are conceptualized on the level of social relationships. These social relationships are derived from the psychological orientations of the members of a group in the process of developing social cohesion. The analysis utilizes small groups with varying degrees of social cohesion, and attempts to show the changing psychological, or individual orientations of the members to each other, resulting in the emergence of small group social and cultural systems, as social cohesion develops.

The study further seeks to systematically relate a conceptual scheme to empirical data. It seeks to revise, adapt, and integrate a theoretical formulation with empirical research, centering this integration about the concept of cohesiveness.

In a series of ex post facto experiments new concepts are substituted for those used by the original researcher, so that the data may be reinterpreted to uncover relationships which were not observable in terms of the original conceptual scheme. Studies of ongoing groups are used, as well as certain controlled, laboratory experiments. In addition, data from an original study by the author are utilized.

It is hypothesized that the development of cohesiveness through interaction in a small group involves a change in the patterns of orientation of the members to each other from: (1) specificity to diffuseness; (2) affective-neutrality to affectivity; (3) self-orientation to collectivity-orientation; (4) universalism to particularism; (5) achievement to ascription.

The results show that diffuseness, affectivity, collectivity-orientation, particularism, and ascription are found in groups which are judged to be cohesive by independent measures. There is evidence to support the hypothesis that these elements are mutually dependent, and that they thus form a "cohesive complex." The introduction of diffuseness, collectivity-orientation, or affectivity as an independent variable will further the development of the other elements of cohesiveness. Particularism, however, is a dependent variable which cannot be experimentally introduced by itself. Ascription, as an element of cohesiveness, must be based on achievement in terms of common value orientations.

In the second part of the study this conceptual scheme is used to resolve theoretical controversies involving the concept of cohesiveness. It is also used to reconcile seemingly conflicting data, and to clarify the results of certain research studies.

170 pages. \$2.13. MicA 55-230

THE ACADIANS OF PORTSMOUTH:
A STUDY IN CULTURE CHANGE

(Publication No. 10,612)

Marc-Adelard Tremblay, Ph.D.
Cornell University, 1954

This dissertation analyses the processes of acculturation in a bi-cultural community where English Protestants and French-Acadian Catholics are approximately in the same numerical proportions. The community studied, Portsmouth, is located in Stirling – a county of the Maritime Provinces of Canada – where Cornell University has an ongoing research project.

Acculturation, as conceived in this study, is a process by which the Acadian Catholics are losing to varying degrees their native traditions and replacing them by their English counterparts.

The questions treated in the thesis can be listed in the following manner: (a) The nature of acculturational processes; (b) The direction of acculturation; (c) The factors and events promoting or limiting the influences of the donor group upon the receiving group; (d) The levels of acculturation of Acadian adults; (e) The predominant socio-economic characteristics associated with degrees of acculturation; and finally (f) The main foci of inter-ethnic and inter-religious struggles in the community.

The central focus of the dissertation is to determine what are the main cultural elements lost in the culture-contact situation, under what socio-environmental conditions and by what kinds of individuals?

In order to discover the levels of acculturation of the Acadian Portsmouthites, a baseline is established by describing the traditional sentiments found in rural, folk-like Acadian communities, with emphasis on the most relevant historical factors which fostered their development.

Portsmouth as a whole is described under such headings as geography, industrial life, social stratification, leadership, organizational life, leisure activities and social control. The purpose of this is to underscore the kinds of socio-cultural conditions existing in a mixed community and their impact on the value-changes of the migrant or Portsmouth-born Acadian.

A principle effort is to measuring the general levels of acculturation of the Acadian Portsmouthites. For this purpose an index of acculturation is developed and applied (utilizing language skills and religiosity) and each Acadian adult receives a score. Various levels of acculturation are compared to such factors as age, sex, occupation, marital status, family situation, place of origin and class membership.

The thesis is terminated by a section on the processes of acculturation and such items as inter-marriage and the mixed school are analysed from the viewpoints of factors promoting acculturation and inter-group struggles.

The main findings of the investigation can be listed as follows:

(A) Concerning the mixed community:

- (1) Acadian Portsmouthites hold a minority group status in relation to Portsmouth English Protestant and Saint-Malo Acadians.
- (2) Acadian-French and English class systems hinge on ethnic and religious loyalties with the Irish in a marginal position because of English class loyalties and Acadian religious loyalties. To rise in social prestige they must divorce themselves from one or the other group.
- (3) English Protestants dominate most community organizations, but Acadians have gained strength in the last decade, especially in economic and political areas.
- (4) Segregation of Acadian Catholics and English Protestants is a function of class – with most interaction at the lower level and least at the higher.
- (5) Religious differences highlight Acadian-English functions, seen particularly in control of the school.
- (6) While Acadian leadership is the important factor counterbalancing the acculturation process, the presence of two Acadian factions reduces this effect.

(B) Concerning the acculturation process and state:

- (1) The family, as a unit, acculturates – not the individual. Marriages are between individuals of similar acculturation levels.
- (2) Inter-marriage is an index of propinquity between two groups and the frequency of their interaction. The majority of conversions are nominal.
- (3) Inter-ethnic contacts are more frequent at the neighborhood level, intermediate on the job, and fewer in leisure activities.
- (4) Faith preserves language, and language preserves Faith, – hence Catholicism is the Acadian culture element last dropped in the acculturation process.
- (5) Males are more acculturated than females; the young more than the old; low socio-economic status is associated with a high degree of acculturation. Those born in the Portsmouth area are more highly acculturated than immigrants originally born in Saint-Malo.

373 pages. \$4.66. MicA 55-231

SOCIOLOGY, PUBLIC WELFARE

**SOCIAL SECURITY IN GUATEMALA:
A CASE STUDY IN BUREAUCRACY AND
SOCIAL WELFARE PLANNING**

(Publication No. 10,438)

Leo Arthur Suslow, Ph.D.
University of Connecticut, 1954

Statement of the Problem

In 1946 Guatemala enacted an institution whose end was to provide a minimum level of protection to the social body. The Guatemalan Institute of Social Security was created to accomplish that end. This social organization was developed along the lines of a technical rational bureaucracy which was charged with the task of providing social security for the entire country. The administration of the technical rational bureaucracy attempted to institutionalize cash benefits, medical care, and other aspects of social welfare in Guatemala by a radically different type of social security system from that of the classical reserve social insurance system.

The basic theoretical objective of this study is to analyze the relationships between the Guatemalan Institute of Social Security and its setting. The pragmatic purpose is to provide a case study of a problem-solving instrument of import in the world today. The hypothesis is: if a technical rational bureaucracy is placed within a traditional culture, then it will be subject to its particular environment in terms of the means at its disposal, its ability to accomplish its goals and ultimately its basic character and very existence. The study attempts to delineate the most relevant social forces, social structures, norms and individual motivations which affect a particular type of social security organization developing within a specific Latin American country.

Procedure

The study is limited to the early formative years of social security ending with the change in the leadership of the bureaucratic organization in March 1951. During the field work in 1950 the following methods were used: personal observation, "open-end" interviews, and investigations into the files of the Guatemalan Institute of Social Security. Secondary source material, unavailable to the writer outside of Guatemala, was collected.

Results

The mores of the partisan politics and traditional "spoils system" of Guatemala did not permit the rational realization of the goals of the bureaucratic organization. Technological development and specialization which offer a sense of order, organization and efficiency does not exist in sufficient quantity and quality in Guatemala. Where acculturation to the values of technical rational social organization had reached its high point - as among the modern

businessmen - acceptance of the Guatemalan Institute of Social Security was at its peak.

Conclusions

A technical rational bureaucracy of the scale demanded by a national social security system cannot be placed within a traditional culture - for the reason that in the first place it cannot even be created. The Guatemalan Institute of Social Security never was such a bureaucracy. It was not technical, because it could not secure adequately trained functionaries and select them according to their objective qualifications - and it was not rational in the sense that it was designed and executed in strict accordance with the specific needs and possibilities of its particular cultural environment.

For most of Latin America a technically rational program of public health should receive priority over social security programs. The emphasis should be on decentralized public health centers oriented to the needs of the local communities.

373 pages. \$4.66. Mic 55-9

SOCIOLOGY, RACE QUESTION

**PATTERNS OF SEGREGATION,
DISCRIMINATION AND INTERRACIAL CONFLICT:
ANALYSIS OF A NATIONWIDE SURVEY
OF INTERGROUP PRACTICES**

(Publication No. 10,577)

Robert Lee Eichhorn, Ph.D.
Cornell University, 1954

The objectives of this study were threefold: to present a report on the extent of segregation, discrimination and interracial conflict in urban areas of the United States and of organizational activity to change conditions confronting Negroes; to isolate some factors related to the incidence of segregation, discrimination and conflict; and to define conditions conducive to the development of organized minority-group protest and to see what types of action seem effective in eliminating discriminatory practices.

Data were collected by questionnaire sent to intergroup relations officials in a sample of 248 cities. Respondents were asked such things as whether schools in their city were segregated, whether Negroes were served in restaurants and whether Negroes had been prevented from moving into a white residential area. Field workers visited a sub-sample of the cities to corroborate respondents' reports and collect qualitative data.

Current Picture of Intergroup Practices: While segregation, discrimination and conflict are quite common, there are signs of change. The more violent forms of conflict are less prevalent than reported in

the past. Also, the more obvious forms of segregation in public facilities have largely disappeared from Northern cities. But other forms of social and economic discrimination are still common practices.

The incidence of segregation, discrimination and conflict is higher in the South than the North, but within each region, Negro-white relations are more tense in larger cities than the smaller towns. In larger cities, too, intergroup relations organizations are more active. Especially in larger Northern cities, protest organizations seem better able to achieve their goals.

While these generalizations stand as statistical tendencies, there are exceptions. Some kinds of conflict and discrimination are more often reported in Northern cities than Southern cities or in small towns than big cities. There are also differences between cities of the same region and size.

Factors Related to High Incidence of Segregation, Discrimination and Conflict: The region in which a city is located, the city's size and the proportion of Negroes are fairly good predictors of patterns of intergroup behavior. Demographic variables, such as income level, mobility rate, population growth or unemployment rate have predictive value only in rather special circumstances.

There is a rank order of discrimination practices. For example, Negroes are seldom excluded from a city's theaters if served in its restaurants. Although cities fall at different points on the scale, the order of the items is invariant from city to city.

But there is also considerable variation in some forms of discriminatory practices. Where norms of behavior are poorly defined or in conflict with prevailing practices, the patterned nature of discrimination breaks down.

Where Negroes are residentially segregated, segregation of other kinds, discrimination and interracial conflict are more crucial problems. There also, Negroes develop institutions parallel to those in the white community and tend to join protest organizations.

Development of Organized Minority-Group Protest and Effective Types of Action: Negroes react most militantly to segregation and discrimination in cities where some gains have been made in abolishing discrimination. A Negro community sensitive to discrimination, led by an aspiring Negro middle class, and realistically hopeful for more equal treatment tends to support "militant" organizations.

Intergroup relations organizations are most effective in achieving their goals when they take into account traditional patterns of race relations, presence of other protest organizations in the community and presence of an organized opposition. Success is affected by the support of the minority community, size of organization, quality of leadership, composition of membership and the organization's affiliations. Organizations are more likely to succeed if they interest influential community leaders and have sanctions at their disposal.

297 pages. \$3.71. MicA 55-232

SPEECH - THEATER

CREATIVE RELATIONSHIPS BETWEEN DRAMATIST, ACTOR, AND AUDIENCE IN THE ACTED PLAY

(Publication No. 10,578)

Brobury Pearce Ellis, Ph.D.
Cornell University, 1954

Chairman: Walter H. Stainton

The acted play was at its best in the theatres of Aeschylus, Shakespeare, and Molière, where it existed as a unified art form, rather than as a combination of a literary drama with the techniques of theatre art, as it tends to exist today. In those best theatres, the acted play was created from the closely-related impulses of dramatist, actor, and audience. When all three shared a devotion to the ideational aspect of the play, the spontaneous responses of actor and audience in the theatre were responses to that ideational aspect, not to a form of entertainment that accompanied it and competed with it. Creative relationships between dramatist, actor, and audience were close.

Because our modern theatre exists chiefly as an amusement, and actors and audience are not strongly devoted to the ideational aspect of the play, they use the area of spontaneity allowed to them in the theatre for the creation of trivial responses not closely related to that ideational aspect. For this reason, serious dramatists have severely limited the area of spontaneity allowed to actors and audience; the play is to a far greater extent an individual creation of the dramatist in which actor and audience are allowed to make comparatively small creative contributions. The creative relationships between dramatist, actor, and audience are weak.

The thrill of a theatrical performance is in the spontaneous responses between the actor and the audience. Our serious theatre today, where those responses are limited, is far less exciting than the best theatres of the past. Furthermore, since the weak relationships of the modern theatre have not produced any work as great as that produced when relationships were close, we must assume that weak relationships are less artistically productive also.

The conditions that weaken those relationships in the professional theatre cannot easily be changed.

Those conditions do not exist in college theatres, yet the production methods used in college theatres tend unnecessarily to imitate the weak relationships found in the professional theatre. By choosing to imitate the close relationships that prevailed in the best theatres instead, colleges can do better work than they are doing at present.

This study explains the nature of those creative relationships as they operated in some of the best theatres of the past, seeking to account for the developments that progressively weakened them since the time of the Renaissance. Equal space is devoted to an explanation of the nature of those creative relationships in the contemporary professional theatre and to the methods of the college theatre that are imitated from it, indicating also some of the changes in those methods that appear to be necessary in order to strengthen those relationships.

203 pages. \$2.54. MicA 55-233

THE PUBLIC SPEAKING OF ARTHUR M. HYDE

(Publication No. 10,110)

Robert Phillip Friedman, Ph.D.
University of Missouri, 1954

Supervisor: Bower Aly

This study is a rhetorical criticism of the speeches of Arthur M. Hyde of Missouri. It presents a description and analysis of the speaker's development, the speaker, the speeches, the audiences, and four selected occasions. During almost fifty years of public life Hyde, who occupied platforms in Missouri and the nation, was accounted a forceful and persuasive speaker.

Hyde received an excellent education. He completed his preparatory work at Oberlin Academy, took his bachelor's degree at the University of Michigan, and graduated law school at the State University of Iowa. At all three institutions he had training and practice in public speaking. Almost immediately after completing his education he took his place in the political affairs of north Missouri.

As a speaker, Hyde possessed a pleasing appearance, an ingratiating personality, and a fearless adherence to his convictions. He first attracted state-wide attention when he bolted the Republican party and ran for state Attorney-General on Missouri's Progressive ticket in 1912. Although decisively defeated in the election Hyde retained his progressive ideas when he rejoined the Republican party in 1916. Meanwhile he had become well known in north Missouri both as a politician and as a successful Bible class teacher. He gained state-wide recognition for his effective Liberty Loan speeches and determined to run for Governor of Missouri. Elected in 1920, Hyde gave the state a highly progressive administration.

Hyde's political thinking began to become more conservative during his term as Governor, when

much of his program was lost through referendum, one of his own progressive principles. By 1929, when Hyde became Secretary of Agriculture, he found President Hoover's idea of "rugged individualism" attractive and embraced its philosophy. In the New Deal period Hyde was termed an extreme conservative.

Throughout his career Hyde argued for equal opportunity, individual liberty, and personal responsibility. The Declaration of Independence and the Constitution formed the basis of his political thought; church, home, and school were the foundation stones on which to build a good life.

Although Hyde made felicitous occasional addresses, he was principally a political speaker. He excelled in rough-and-tumble campaigning; he was an aggressive speaker, possessed an excellent style, and flavored his addresses with delightful wit and scathing satire.

In his early years Hyde spoke to the people of north Missouri; they found his utterances attractive and followed his leadership. In turn the people of the state responded to his appeals and awarded him with public office. The great depression precluded any possibility that Hyde had for developing a sizeable national audience. In later years Hyde argued for a return to "Republican principles." He did not propose a specific program on which the voters could register a direct opinion; his popularity waned as new leaders took charge and more liberal ideas attracted the nation's electorate.

Four occasions are documented to show the speaker at work. His message to the Young Republicans Association on February 12, 1918, demonstrates his early florid style. His attack on his Republican opponent in the gubernatorial primary on July 28, 1920, illustrates Hyde's capacity for aggressive campaigning. His speech on April 30, 1930, denouncing the Chamber of Commerce for its stand on Hoover's agricultural program exemplifies his ability to deliver an effective impromptu speech. And his address before the South Carolina Annual Conference of the Methodist Episcopal Church South on November 1, 1935, typifies Hyde's political and religious thinking during his last years.

Hyde was an effective speaker; his audiences invariably enjoyed hearing him and often followed his leadership. Nationally, he is largely forgotten; in Missouri he is remembered as the state's most outstanding Republican campaigner of the past half-century.

714 pages. \$8.93. MicA 55-234

THE POSITION AND CHARACTER OF
THEATER-IN-THE-ROUND
IN THE UNITED STATES

(Publication No. 10,482)

Joseph Golden, Ph.D.
University of Illinois, 1954

This study is an attempt to describe the current position of theatre-in-the-round in the United States and to determine its fundamental aesthetic character.

The large body of writings by arena practitioners and critics reveals that theatre-in-the-round came into existence largely as a result of high production costs. Schools, summer theatres, music circuses, professional community theatres, and at least two professional New York theatres adopted the arena style primarily for the savings it afforded in money, time, and labor. Buildings erected as arena theatres exclusively such as the Penthouse Theatre in Seattle, the Circle Theatre in Houston, and the Carousel Theatre at the University of Tennessee suggest it has achieved some permanence.

Although the arena is a distinct departure in form from the proscenium arch stage, it has been employed largely as a medium for the realistic play. The change in form has not been accompanied by a change in style nor in artistic theory. In certain limited respects the arena can achieve an illusion of reality. The closeness of the spectators, like the audiences of the European Naturalist playhouses of the 1880's and 90's, seems to compel arena actors and designers to provide a more detailed imitation of life. However, there are significant limitations on the achievement of illusion in the arena. Because of the lack of walls and the attendant elimination of natural light sources such as windows, doors, skylights, or sky, a complete life-like environment is impossible. Moreover, the spectators are visible to one another and are often unintentionally illuminated by a spill of light from the acting area, and consequently the feeling of separation between audience and play which appears to be essential to the creation of an "illusion of reality" is weakened if not destroyed.

As a medium for the realistic play, the arena theatre contributes little that is new to American theatre art. The aesthetic character of the arena, therefore, must be deduced from the historical theatre forms and from modern theories of production which seem closely related to theatre-in-the-round.

Among modern theories of production, the New Stagecraft movement, which began in Europe about 1880 and appeared in the United States about 1915, seems to be strongly related to theatre-in-the-round. Appia, Craig, Jessner, Piscator and others called for treatment of the stage as plastic space in which actors and scenic forms are completely three-dimensional; the arena stage can be treated in no other way. Meyerhold, Tairov, Jessner, Fehling, and Hilar discarded painted scenery; painted scenery is impossible in the arena. Fuchs, Reinhardt, Jessner, Fehling, Copeau, and Ohklovkov sought by various means to reunite actors and audiences; arena theatre achieves this reunion without effort. The New Stagecraft

movement also revived historical stage forms which seem related to arena theatre, Reinhardt revived the Greek orchestra; Meyerhold, Kemendy, and Copeau revived the Elizabethan platform; and Ohklovkov employed a circular or square stage completely surrounded by spectators.

One important characteristic of the New Stagecraft is its non-naturalistic character. Although many arena practitioners recognize this, it has not affected their general style of arena production.

Theatre-in-the-round seems related also to the platform stages of the Greek, Oriental, Medieval, Italian commedia, and Elizabethan playhouses. The stages of these theatres were open on at least three sides; the arena is open on all sides. In these theatres the actor was usually in close contact with the spectators; the arena actor is always in close contact. Stage settings and properties in the older theatres were simple and frequently symbolic; the limitations of space and sightlines in the arena compel directors to keep settings and properties at a minimum. Production in the older theatres as in the New Stagecraft was non-representational.

The historical background and physical nature of the arena theatre suggest that its essential character also is non-representational. This has not been fully recognized by arena practitioners. However, if actors, playwrights, and theatre architects come to realize the true character of theatre-in-the-round, there may be important changes. Dramas may symbolize or express life rather than imitate its surface features; actors may present their roles instead of representing them and draw the spectators into the play rather than isolate themselves in an illusory world; and architects may design arena theatres which are larger and in this and other ways emphasize and encourage audience response.

160 pages. \$2.00. MicA 55-235

EXPERIMENTAL STUDIES OF THE
SPEECH CONTROL SYSTEM

(Publication No. 10,484)

Newman Guttman, Ph.D.
University of Illinois, 1954

A group of four experiments were performed representing inquiries into the relationships between the speech output and the speaker's sensations as he produces that output, and they have in common general procedures of controlling sensation, measuring output and studying the latter as a function of the former.

The results of the first experiment showed that when the intensity of the auditory feedback was increased by high-level amplification no significant changes were found in number of correct words, duration, correct word rate and mean sound pressure. When the prominence of the auditory feedback was decreased by means of heavy masking, correct words, duration and correct word rate remained

unchanged, but the mean sound pressure increased 10 decibels. When the auditory feedback was delayed, number of correct words decreased, duration increased, correct word rate became slower, mean sound pressure became greater. Differences between the sex groups were small, although duration was significantly longer for the female group and correct word rate was correspondingly slower.

In the second experiment certain of the oral structures were anesthetized with the intention of reducing non-auditory feedbacks from the articulatory mechanism. Performances under this condition under widely different auditory conditions were characterized by fewer correct words, increased duration and decreased correct word rate, but sound pressure did not change significantly. No evidence of auditory and non-auditory interaction was obtained. The results support the hypothesis that specific dimensions of the output are supported by specific feedbacks in the speaking system.

In the third experiment subjects whispered and spoke under three different auditory conditions. Whisper and speech were not found to differ in number of correct words. The whisper performances were significantly longer in duration and significantly slower in correct word rate, but it is believed that these differences must be attributed largely to basic physiological factors. Variations of the output were very similar in both types of speech act.

In the fourth experiment subjects were given various output objectives for a series of reading performances under delayed auditory feedback by means of instruction. When the instruction was general unspecified improvement, the number of correct words did not change substantially, but duration was significantly shortened to a duration approximately one-third greater than normal. If correct word rate is a measure of efficiency, the average subject was most efficient when instructed to read as fast as possible, and least efficient when instructed to concentrate upon normal articulation.

95 pages. \$1.19. MicA 55-236

POPE'S THEATRE AND ST. LOUIS THEATRICAL HISTORY: 1879-1895

(Publication No. 9576)

James Alan Hammack, Ph.D.
State University of Iowa, 1954

Chairman: Professor Edward C. Mabie

The purpose of this study of St. Louis theatrical history from 1879 to 1895 is three-fold. The first purpose is to assemble information on Charles R. Pope (1832-1899) an actor and theatre manager of the latter half of the nineteenth century. The second purpose is to attempt to estimate how much effect Charles R. Pope and Pope's Theatre had on St. Louis theatrical history. The third purpose is to attempt to estimate the interrelationships between the people

of St. Louis - their social and cultural activities - and the growth and flourishing of Pope's Theatre, a representative St. Louis major theatre of the time, during the years when there was more St. Louis professional theatrical activity than at any time prior to 1879.

The nature of the study involved the examination of approximately 458 programs of Pope's Theatre covering the years 1879 to 1893; St. Louis newspapers of the period - especially the Post-Dispatch and the Globe-Democrat; reports contemporary with Pope's Theatre - such as Board of Education reports, library reports, and U. S. Census Reports; and deeds and leases pertaining to Pope's Theatre and Charles R. Pope. Secondary source materials also were examined, and much correspondence was done.

From 1815 to 1895 St. Louis was a city where much theatrical activity occurred. From 1877 to 1879 when Charles R. Pope erected his theatre, theatre in general in St. Louis was at a low ebb. Poor attractions, profit-minded managers, and wrangling over ownership of one of the two major theatres were the reasons for this low ebb. The theatre minded St. Louis people were happy to see a third theatre, Pope's Theatre, come into existence. After the erection of this new theatre, more theatre building occurred in the ensuing 15 years than had occurred in the 64 years prior to 1879, theatrical competition came into the picture, and theatrical attendance improved.

With the stock company system having been abolished in St. Louis at the end of the 1877-1878 season, St. Louis entered a new theatrical era - one of the traveling companies or combinations. Charles R. Pope by means of this theatrical experience - 31 years as an actor and 9 years as a theatre manager - helped St. Louisans from 1879 to 1887 become accustomed to the new theatrical era by presenting a variety of theatrical fare which the whole family could appreciate and at prices the people could afford. Charles Pope had high standards as regards theatrical fare and these were followed by the managers of Pope's Theatre during 1887 to 1895.

St. Louisans who attended Pope's Theatre during its existence liked plays, especially the melodramatic ones, and musicals the best. They further preferred, in the order given, opera, minstrelsy, and variety. The theatrical fare presented at the other major theatres showed the same audience preferences in the identical order as listed above.

Charles R. Pope presented (as did the other major theatres) some of the famous American stars and famous foreign stars who were appearing before the public in the last two decades of the nineteenth century.

St. Louis certainly gained by having had Pope's Theatre built in 1879.

482 pages. \$6.03. Mic 55-10

ARISTOTELIANISM IN THE RHETORICAL THEORY OF KENNETH BURKE

(Publication No. 10,490)

Laura Virginia Holland, Ph.D.
University of Illinois, 1954

The purpose of this thesis has been to discover the Aristotelianism in Kenneth Burke's rhetorical theory. Burke's rhetorical theory was compared with Aristotle's from four perspectives: (1) function, (2) definition, (3) scope, and (4) methodology. In summation, we believe we may set forth these findings: Burke and Aristotle agree upon the function of rhetoric. They believe it is to serve as an instrument for the social critic. They contend that its immediate function is to persuade, and its ultimate function is to promote social cohesion, and perfect society. The essence of Burke's definition of rhetoric and Aristotle's is the same. Both agree that rhetoric is a body of principles characteristically concerned with the discovery of all the available means of persuasion inherent in the linguistic symbol. Burke's conception of the social critic who would use this body of theory differs from Aristotle's. Burke contends that rhetorical principles are to be observed and applied by both the speaker and the writer. Aristotle would confine the study and use of rhetoric to the speaker. Burke and Aristotle agree concerning the scope of rhetoric. Burke, however, has gone beyond Aristotle in his treatment of and elaboration upon what Aristotle has referred to as the non-technical means of persuasion. Burke and Aristotle agree in essence about the methodology of rhetoric. Both have a dramatistic approach. Although Burke has no detailed treatment of style such as Aristotle's treatment in Book III of the Rhetoric, both agree that stylistic devices, viewed as a composite, are the over-all style or form and are themselves persuasive. Burke has gone beyond Aristotle in his treatment and classification of strategies. His strategies of content and form should provide us with instruments that are more descriptive, and hence more revealing from an analytical standpoint, of what is going on in language that persuades.

It is apparent, therefore, that Kenneth Burke's rhetorical theory is grounded in the doctrines of Aristotle. There is nothing in Burke's rhetorical theory which is not implicit in Aristotle. In several respects, however, he has gone beyond Aristotle, and made the implicit explicit. This is especially apparent in his handling of the non-technical means of persuasion, and of strategies of form and content.

Burke is well aware of his lineage. In the preface to A Rhetoric of Motives he says, "Traditionally, the key term for rhetoric is not 'identification,' but 'persuasion . . .'" Our treatment, in terms of identification, is decidedly not meant as a substitute for the sound traditional approach. Rather, as we try to show, it is but an accessory to the standard lore. And our book aims to make itself at home in both emphases." Consequently, we might say then that Burke is interpreting the classical tradition for the twentieth century. 146 pages. \$1.83. MicA 55-237

A PSYCHOPHYSICAL STUDY OF SPEECH RATE

(Publication No. 10,494)

Charles Lee Hutton, Jr., Ph.D.
University of Illinois, 1954

This investigation was concerned with certain aspects of the temporal relationships of speech which are commonly encountered, but which were heretofore explored in only a limited manner. An experimental procedure was arranged to permit investigation of the functional relationships between the perceived and measured rates and durations of speech samples, preferred speech rates, and the perceptual effects of time compression and expansion of speech. Appropriate stimulus materials were prepared, measured and presented to groups of observers for judgments of various types, and the relationships between measurements and judgments were analyzed. Within the limitations of the experiment, the following were the major findings:

1. Estimated rate was found to be a logarithmic function of measured rate in words per second during the total speaking time. This measure of rate exhibited the best relationship to estimated rate among seven rate measures considered.

2. Estimated duration was related linearly to measured total duration, and was approximately 1.2 times the latter within the range considered.

3. Since it appeared unlikely that duration estimates were based directly on physical duration, the relationship between estimated duration and measured rate was explored, with the finding that estimated duration was proportional to the reciprocal of rate in words per second during the total speaking time.

4. Equations were derived from the above mentioned data for predicting estimated rate from measured rate, estimated duration from measured duration, and estimated duration from measured rate.

5. The judged appropriateness of the rate of a given speech sample was found to be an inverse linear function of the difference between the estimated rate of the sample and the estimated rate most preferred. An objective expression of this relationship in the form of an index was proposed and applied to the data.

6. Speech performances with inappropriately slow or fast rates were found to be substantially improved by automatic time compression or expansion toward the most preferred rate level. When rate was changed by time compression or expansion, estimated rate and duration changed correspondingly in appropriate directions and amounts.

77 pages. \$1.00. MicA 55-238

AN INVESTIGATION OF WORD INTELLIGIBILITY AS A FUNCTION OF TIME COMPRESSION

(Publication No. 10,498)

Francis Kodman, Jr., Ph.D.
University of Illinois, 1954

Studies of intelligibility as a function of duration have been limited in number and confined to methods which have certain disadvantages. More recently, an automatic device has been designed and built which compresses the duration of speech by periodically sampling the signal and abutting the retained segments without discontinuity. Utilizing this automatic time compressor, the general plan was to select a representative set of compression ratios at each of several discard intervals, process the same group of words under each of these conditions, and present each of the processed versions of the words to the same group of trained observers.

The following were the major findings:

1. Intelligibility varied inversely as a function of time compression, or in direct relation to the proportion of the signal remaining after time compression.
2. Intelligibility varied with the duration of the discard and sampling intervals, decreasing progressively as such intervals became long in relation to the durations of the signal units.
3. Within the range of values considered, the percentage of intelligibility invariably exceeded the percentage of the signal remaining after time compression.
4. When the discard and sampling intervals were short the percentage of intelligibility was approximately five times as great as the percentage of the signal remaining.
5. When the discard and sampling intervals were long the relative excess decreased, and the percentage of intelligibility appeared to become increasingly dependent upon the proportion of sub-word units sampled.
6. The minimum percentage of the signal's duration necessary for 100 percent intelligibility was estimated to be 30 percent, and the temporal redundancy of the signal, under the specific conditions of this experiment, to be 70 percent.
7. The intelligibilities of individual words were strongly related to their durations. They were also related to certain combinations of non-durational attributes, although the latter were restricted in range by the conditions of the experiment.
8. Under conditions in which the possibilities of correct identification were restricted to a known number of well-known alternatives, the non-auditory identification of words was directly related to the proportion of the total word perceived, the function being S-shaped.

68 pages. \$1.00. MicA 55-239

THE TEMPORAL COURSE OF CHANGES IN THE AMOUNT OF VOCAL DISTURBANCE PRODUCED BY DELAYED AUDITORY FEEDBACK

(Publication No. 10,517)

Jay Melrose, Ph.D.
University of Illinois, 1954

When a speaker's vocal output is delayed experimentally and returned to his ears after a short interval while he continues speaking, a pronounced effect upon his speech may be observed. In the case of many formal experiments, and in informal observations of hundreds of subjects reading under conditions of delayed auditory feedback, it was not demonstrated that any normal-hearing individual was free of disturbance in all the vocal attributes: fundamental frequency, vocal intensity, duration and articulation. The question arose as to whether or not the average reader, given proper motivation, could learn to improve his performance substantially as a function of practice over an extended period of time.

Twenty young adult male subjects were placed in an experimental situation in which each read a series of 40 matched sentences under instructions to read as well as possible. The vocal output of each subject was recorded, measured, and analyzed. Following were the major results:

1. The number of correct words, duration, correct word rate and relative sound pressure changed significantly during the course of the readings. The pattern of change for each reading, however, was found to be different. The number of correct words per sentence increased in the general pattern of a sigmoid learning curve. Duration increased steadily during the first half of the experiment and then decreased. Correct word rate reflected the course of the changes in correct words and duration. Sound pressure was found to increase over the course of the readings, the greatest proportionate increase occurring during the reading of the first five sentences. These changes were interpreted as supporting the view that improvement of articulatory accuracy is the primary objective of a reader attempting to overcome the disturbance in vocal output resulting from time delay.
2. The greatest internal changes from word to word within sentences occurred during the early sentences, the first sentence demonstrating the greatest internal change.
3. The 'shock effect' of delayed auditory feedback, prominent at the beginnings of sentences in the early readings, decreased progressively and became negligible by the end of the readings.
4. Although the average subject significantly and progressively improved his output during the course of the experiment, his ultimate level of performance at the end of the experiment was still very much inferior to his usual level as measured by control readings.

70 pages. \$1.00. MicA 55-240

**A RHETORICAL CRITICISM OF THE
SPEECHES OF HERBERT SPENCER HADLEY**

(Publication No. 10,127)

Victor Morgan Powell, Ph.D.
University of Missouri, 1954

Supervisor: Bower Aly

Herbert Spencer Hadley was born in Olathe, Kansas, in 1872, and died in St. Louis, Missouri, in 1927. He served as Attorney General and Governor of Missouri, as floor manager for Theodore Roosevelt in the Republican national convention in 1912, and as Chancellor of Washington University. In a relatively short life Herbert Hadley attained notable success as a lawyer, as a politician, and as an educator. In all these endeavors his ability as a speaker contributed to his success.

This study centers attention upon Hadley's speaking. It seeks to discover the methods he used and the influences that shaped them. The elements of the speaking occasion - the speaker, the speech, and the audience - provide the basis of organization for the study of Hadley's rhetoric. Particular attention is given to Hadley's speaking as a lawyer, as a politician, as a Chautauqua and Lyceum lecturer, and as an educator.

Hadley's speech composition reflects painstaking craftsmanship. Careful organization and detailed attention to word choice characterize the speech manuscripts. The style of the speeches shows an evolution that supports Hadley's stated opinion that public taste largely determines the style of public address. He stepped upon the public platform in the day of the new "Manifest Destiny," when extravagant embellishments of oratory were in keeping with the expansionist spirit. The extravagant figures and contrived effects of his early speeches reflect the spirit of the times. As the fever of expansionism declined and the era of the progressive movement began, the abundance of figures of speech and the relative absence of factual forms of support that marked the early speeches undergo a gradual change. By 1910 elaborate figures of speech and contrived oratorical effects give way to large quantities of statistical evidence, specific instances, and concrete examples.

Thorough in preparation, vigorous and direct in delivery, Hadley earned the reputation of an accomplished speaker. He was handsome, though not imposing in appearance. Perhaps his greatest physical asset as a speaker was his voice, which was strong, pleasant, and well controlled.

No aspect of persuasion impressed Hadley more than did the role of the speaker's character and personality in gaining assent for an idea. He consciously sought to present to his hearers what Emerson designated the "authentic sign." If a single attribute could be labelled the source of Hadley's strength it would be this factor which the ancient rhetoricians called *ethos*. At the Republican national convention of 1912 his demeanor, his ability to impress his audience as one who possessed the triumvirate of

virtues - sagacity, character, and good will - earned him a respectful hearing while all others were hooted down.

Exceedingly sensitive to audiences, Hadley demonstrated in his speeches and writings his analysis of the Missouri audience. He recognized above all else an inherent conservatism in Missourians, and their conservatism left an unmistakable imprint on Hadley's approach to Missouri audiences. Though he appeared as spokesman for the liberal or progressive element of his party, his appeals for reform are invariably couched in terms of moderation. He chose always to appear as a temperate man, urging only those reasonable and just changes that would preserve the essentials of the prevailing system. Nothing about Hadley suggests that his attitude was a pose contrary to his natural inclinations; it seems rather the position most congenial to his own assumptions about society.

296 pages. \$3.70. MicA 55-241

**STARK YOUNG: A BIBLIOGRAPHY OF HIS
WRITINGS WITH A SELECTIVE INDEX TO
HIS CRITICISM OF THE ARTS**

(Publication No. 10,609)

Bedford Thurman, Ph.D.
Cornell University, 1954

This work is intended as a bibliographical aid to the study of Stark Young's criticism of the arts in general and of the theatre art in particular.

Part I provides a complete chronological bibliography of the published works of Stark Young from 1905 to August, 1953. The Bibliography is organized into five divisions: (A) bibliography on Young; (B) books by Young; (C) a short-title chronological list of Young's books; (D) books, anthologies, or collections containing writings by Young; (E) writings by Young in newspapers and magazines. Items within each category are listed chronologically, with an indication of the formal literary type of each selection - whether poem, original or translated play, long or short fiction, criticism, or general essay.

The titles of the newspaper and magazine writings recorded in the fifth and longest division of the Bibliography are all brought together in this study for the first time anywhere. Some early unsigned or pseudonymous periodical writing of Young is identified here, as is some writing that was published in *The New Republic* under the initials "S. Y." These latter essays and drama or book reviews are not included in any other index.

This fifth division incorporates two other features not found in any bibliographical source: (1) it provides a summarizing comment on the general essays of Young; and (2) it provides the essential facts as to the content of each separate titled item Young wrote in such periodicals as *Theatre Arts*, *The New York Times*, and *The New Republic*. For example, the

essay Young contributed to Theatre Arts, February, 1924, appears in the Bibliography - with the symbol (T) indicating theatre essay - as follows:

- (T) "Illusion in Acting," TA, 8:98-102 (FEBRUARY, 1924). Reprinted with a few changes in Glamour, 1925, and Theatre Practice, 1926. Acting is not a matter of imitation, reproduction, verisimilitude; the actor should not be the character, the actor should act the character; the truth of acting lies not in reproduction or duplication, but in idea ("the eternity of love, grief, and death," etc.).

And the theatre review Young wrote in The New Republic, February 14, 1923, appears as follows in the Bibliography:

- (T) "It Is the Lark," NR, 33:321 (FEBRUARY 14, 1923). Reprinted in Immortal Shadows, 1948. Romeo and Juliet. Henry Miller's Theatre, January 24, 1923.

Part II, providing a Selective Index to the Bibliography set forth in Part I, is organized into three divisions: (A) art in general (which has chronological references to the Bibliography according to twenty-five topics or general aesthetic areas discussed by Young); (B) the arts (which, excluding theatre art, refers a reader to the Bibliography under the seven subheadings of: 1 - architecture, 2 - dancing, 3 - literature, 4 - miscellaneous arts, 5 - music and singing, 6 - painting and drawing, 7 - sculpture); and (C) theatre art (which refers a reader to the Bibliography by means of four subheadings: 1 - the art of the theatre, 2 - the elements of the art of the theatre [viewed by Young as being acting, audience, décor, directing, playwriting, producing, and theatre buildings], 3 - critics and theorists of theatre and drama, 4 - history of theatre and drama).

The indexing of a sufficiently representative body of Young's writing is provided in Part II, in order that any interested student will be aided in an investigation of Young's critical theory and practice. Five principles guiding the preparation of the Index were:

- (1) to indicate the location of key essays that clearly reveal Young's aesthetic beliefs and criteria of judgment;
- (2) to cite certain articles which seem to have particular historical value;
- (3) to index Young's total comment on all prominent artists, and on many others, in all phases of theatrical art (for example, the names of 381 actors and 241 playwrights are indexed);
- (4) to employ considerable cross-referencing because of the inter-relatedness of many of Young's ideas; but
- (5) to make no distinction in indexing between a passing comment by Young and an extended discussion by him.

218 pages. \$2.73. Mic 55-11

STYLES OF ACTING IN SERIOUS DRAMA ON THE NINETEENTH CENTURY AMERICAN STAGE

(Publication No. 10,566)

Lael Jay Woodbury, Ph.D.
University of Illinois, 1954

This study describes the principal styles of acting in which serious drama was performed on the nineteenth century American stage, so as to present a perspective view of nineteenth century acting techniques and audience tastes. It is based on descriptions of actual performances contained in reviews, articles, and reminiscences, and on studies of pictures, plays, lighting, costumes, and stage and scenery arrangements.

This evidence reveals five styles of acting distinct and popular enough to warrant study, each of which is described beneath a title indicative of its basic spirit. "The Classic Style" describes the acting of Thomas Abthorpe Cooper, America's most popular actor from 1798 until 1810. "The Romantic Style" describes the acting of George Frederick Cooke, Edmund Kean, Mrs. Mary Duff, Junius Brutus Booth, and William Charles Macready, who were popular in America from 1810 until the 1840's. "The Democratic Style" describes the acting of Edwin Forrest and Charlotte Cushman, who were popular from about 1826 until the 1870's. "The Neo-Romantic Style" describes the acting of Edwin Booth, Lawrence Barrett, and Mary Anderson, who were popular from about 1857 until about 1890. "The Realistic Style" describes the acting of Matilda Heron, Clara Morris, and Minnie Maddern Fiske; a style which was introduced in 1857 but was not dominant until the 1890's.

According to the evidence, the Classic actors performed with an elegance which they believed typical of noble personages. They spoke with melodic tones; they moved with grace and dignity. Often they spoke from elegant poses, and they employed large, open gestures. They made little effort to ignore the audience's presence. Their style was most appropriate in roles like Virginius and Payne's Brutus, and it appealed especially to those who admired the order and refinement which characterized the art of ancient Greece and Rome.

The Romantic actors emphasized the emotions of their impersonations. They employed rapid delivery and complex changes of pitch and rhythm. They moved with abrupt turns and starts, and they gestured impulsively and nervously. They favored emotional plays such as Richard III and A New Way to Pay Old Debts, because their style appealed to those who saw beauty and essential truth in the fundamental emotions expressed without restraint. Their art reflected the new interest in the individual and his capacity for feeling which stemmed from Rousseau and others of the Romantic movement in literature and thought.

Exponents of the Democratic style practiced powerful declamation which exemplified contemporary ideals of elocution. Their movement was bold, but deliberate rather than vehement. They were best in roles like Spartacus and Lady Macbeth. Their

physical strength and confidence were especially admired at a time when rugged individualists were mastering the American frontier.

Neo-Romantic actors practiced precise articulation and abrupt shifts of pitch, speed, and volume. They employed dynamic movement and gestures of considerable emotional intensity, but these were restrained to conform to new tastes. They usually appeared in Shakespearean or other romantic plays. Their style appealed especially to those who, through increased wealth and leisure, had acquired ideals of refinement in manners and art.

Realistic actors portrayed life with scientific objectivity. They spoke with conversational tones, and they moved with no more grace and elegance than one observes in ordinary life. They filled long pauses with restrained pantomime, and they performed without cognizance of their audience. Their style was appropriate in Ibsen's plays and others of the realistic movement, for their depiction of the external characteristics of human behavior appealed to those who held that basic truth is that which the senses perceive.

231 pages. \$2.89. MicA 55-242

ZOOLOGY

A TAXONOMIC STUDY OF THE NORTH AMERICAN LICININI WITH NOTES ON THE OLD WORLD SPECIES OF THE GENUS DIPLOCHEILA BRULLE. (COLEOPTERA: CARABIDAE)

(Publication No. 10,570)

George E. Ball, Ph.D.
Cornell University, 1954

Study of the North American Licinini was undertaken with the realization or feeling that the descriptive phase in this group was complete, and that there would be few if any new species to be described. Thus it seemed to the writer that the time had arrived to begin work on the next phases of taxonomy: studies of geographical distribution, intraspecific variation, and interspecific relationships. However, before such studies could be made it was first necessary to critically evaluate the described species in terms of variation of supposedly diagnostic features, and in terms of structures that had not been previously studied within this group. To this end, careful studies were made of the external morphology, male genitalia, and the female retractile plates. These studies resulted in a certain amount of new synonymy and the description of two new subgenera, three new species, and five new subspecies. The larvae were not studied for two reasons: first there was not enough time, and second, there were not enough larvae of enough species to make such studies profitable at the present time.

Studies in Diplocheila and Badister, begun with the species of the North American fauna, led eventually to a consideration of the Old World species of these two genera. The result was, in the case of Diplocheila, preparation of a synopsis of the Old World species of this genus. Data obtained from examination of certain of the Palaearctic species of Badister were very helpful in preparing a classification of the North American species of this genus.

Finally, representatives of several Oriental and Australian genera of Licinini and descriptions and illustrations of the African genera were studied in

an effort to arrive at an understanding of the position within the Tribe of the licinine genera which occur in North America. These studies have resulted in the preparation of a very tentative classification of all of the licinine genera, arranging them in groups which are the equivalent of subtribes. This arrangement is regarded as tentative because it is based to a large extent on the literature, and on very few specimens. Much work remains to be done at this level but must be undertaken by an individual having a large collection of Licinini of the world at his disposal.

The material examined consisted of the following: Diplocheila, New World, a total of nine hundred three specimens, Old World, one hundred forty one specimens, representing fourteen species; Dicaelus, two thousand four hundred eighty specimens representing fifteen species; Badister, New World, six hundred sixty-six specimens, representing fifteen species, Old World, twenty-one specimens, representing seven species; one specimen of Lacordairia, Siagonyx, Hormacrus, Platylytron, Dilonchus, and Dicrochile; a series of about twenty specimens of Omestes torta Andrewes.

750 pages. \$9.38. MicA 55-243

VITAMIN REQUIREMENTS AND SOME ASPECTS OF UNKNOWN FACTORS IN THE DEVELOPMENT OF THE CONFUSED FLOUR BEETLE, TRIBOLIUM CONFUSUM DUVAL

(Publication No. 10,475)

Ellery Walter French, Ph.D.
University of Illinois, 1954

The vitamin requirements of Tribolium have been the subject of considerable study. The qualitative needs for known vitamins of the B-complex have been determined, but the only quantitative study on the vitamin requirements of Tribolium was that quoted by Fraenkel and Blewett from unpublished data

(Fraenkel and Blewett, 1947. *Biochem. Jour.*, 41:469-475). Previous research has been limited to diets containing a carbohydrate. The presence of unknown factors contained in yeast which are necessary for the optimal development of *Tribolium* have previously been postulated (Fraenkel, 1949. *Fed. Proceedings*, 8:382), but their characteristics have not been determined.

The minimal optimal vitamin requirements of *Tribolium confusum* Duval were determined and compared on diets containing and lacking a carbohydrate. They were found to be as follows, expressed in ug./gm. diet:

1. With a carbohydrate present. Thiamin - 0.2, Riboflavin - 3.0 to 6.25, Nicotinic Acid - 12.5, Pyridoxine - 0.75 to 1.5, Pantothenic Acid - 6.25 to 12.5, Choline Chloride - not required, Inositol - not required, Folic Acid - less than 0.30, Biotin - 0.06, Carnitine - less than 0.10.
2. Without a carbohydrate. Thiamin - 0.2, Riboflavin - 3.0 to 6.25, Nicotinic Acid - 25.0, Pyridoxine - 1.5 to 3.0, Pantothenic Acid - 12.5 to 25.0, Choline Chloride - not required, Inositol - not required, Folic Acid - less than 0.30, Biotin - 0.12, Carnitine - less than 0.10.

The vitamin requirements were similar and of the same order of magnitude whether a carbohydrate was present in the diet or not.

Carnitine was proved to be a required vitamin for *Tribolium*. Larvae grew well in its absence, but adults failed to develop normally unless carnitine was included in the diet. It was shown that quantities as low as 0.10 ug./gm. diet were fully effective in either of the diets used, and that its inclusion in the diet did not alter the quantitative requirements for nicotinic acid and pantothenic acid, and assumedly the other vitamins of the B-complex.

Tribolium, in addition to the vitamins tested, was shown to require at least two unidentified growth factors. The need for these factors was especially pronounced on a diet lacking in carbohydrate. There was a strong indication that these factors are directly concerned with energy metabolism, particularly in the utilization of protein as a source of energy. These factors are contained in defatted wheat germ and defatted pork liver, as well as in brewer's yeast. They are destroyed by ashing, are heat-stable, and become inactive in the presence of strong acids. One of these factors is present in the water-soluble extract of brewer's yeast, the other in the insoluble residue. The factor in the water-soluble fraction was absorbed on charcoal at an acid pH, was dialyzable, and not precipitated by 2% trichloroacetic acid.

130 pages. \$1.63. MicA 55-244

FUNCTIONAL ANATOMY OF THE FEEDING APPARATUS IN WATERFOWL (AVES: ANATIDAE).

(Publication No. 10,483)

Donald Charles Goodman, Ph.D.
University of Illinois, 1954

A study was made of the functional anatomy of the feeding apparatus in 17 species of the family Anatidae. The osteology and myology of the skull and anterior third of the neck were investigated both qualitatively and quantitatively. Wherever possible, differences in osteology and myology in these species have been correlated with differences in food habits and in feeding behavior.

The anatids were divided into two functional groups based on the manner of feeding. The grazers (*Branta canadensis*, *Branta nigricans*, *Chloephaga hybrida*, and *Cygnus olor*), the sea-diving ducks (*Melanitta perspicillata*, *Bucephala clangula*, and *Clangula hyemalis*), and the fish-eaters (*Mergus merganser* and *Lophodytes cucullatus*) use a powerful adduction of the jaws (the grasping-action) to secure the major portion of their food. The strainers (*Anas platyrhynchos*, *Anas carolinense*, *Spatula clypeata*, *Aythya affinis*, *Aythya valisineria*, and *Oxyura jamaicensis*) use a less powerful, but rapid opening and closing of the jaws (the straining-action), to obtain most of their food. *Cairina moschata* and *Dendrocygna autumnalis* seem to be functional intermediates between the grazers and strainers.

The serrations and nail of the bill were described for the anatids; correlations were pointed out between these epidermal structures and the different methods of feeding.

The skulls of the grazers are modified to provide for a strong muscular system and for strength in construction to withstand forceful adduction of the jaws; the relatively short, narrow bill in this group gives more efficient use of force of the muscles. The strainers have a relatively narrow, low skull that is weak compared to that of the grazers. The relatively long bill, expanded at the end, lacks power, but adapts the strainers for efficiently filtering large quantities of water for food particles.

The flattening and widening of the skull in *M. merganser* results in a multitude of adaptations for the fish-eating habit: streamlining for rapid swimming under water, strength, stability, rapidity of movement, and increased swallowing capacity. The long bill of the fish-eaters provides a large gape and more longitudinal edge with which to seize fishes.

The anatomy, function, and innervation of the muscles of the jaws and anterior third of the neck were described; the ligaments of the skull were also described.

The pattern of the jaw muscles in members of the family Anatidae is quite homogeneous. Only in *M. merganser* are there differences that alter the muscle pattern; these are due mainly to the loss in area of muscle attachment secondarily caused by the widening and flattening of the skull.

Other interspecific variations in the muscles were noted, but these differences do not change the

basic pattern. As a group, the grazers differ from the other anatis in only two muscles, and the strainers in one muscle. Functional significance could not be attributed to the muscular differences which separated out these feeding types.

The potential or preadaptive capabilities of the jaw muscles was determined by quantitative methods. The potential effective forces that each muscle may exert in its function were analyzed.

The graspers have relatively large total effective forces of adduction and retraction; a forceful closure of the jaws is necessary for this feeding behavior. The strainers possess low values for adduction and retraction; powerful jaws are not needed for the straining-action.

The power of abduction is greatest in the strainers; this may be correlated with a stirring up of the substrate for straining or inciting insects to move so they can be observed and caught.

The ability to protract the upper jaw does not seem to be correlated with feeding behavior, except in *A. valisineria*.

258 pages. \$3.23. MicA 55-245

LABORATORY STUDIES ON THE TOXICITY OF
SELECTED CHLORINATED HYDROCARBON AND
PHOSPHATE CHEMICALS TO THIRD INSTAR
LARVAE OF THE HOUSE FLY,
MUSCA DOMESTICA LINN.

(Publication No. 10,606)

Lonnie Nathaniel Standifer, Ph.D.
Cornell University, 1954

Twenty-five formulations of 15 chlorinated hydrocarbon and phosphate insecticides were investigated to determine their LD50 and LD95 to third instar larvae of the house fly, *M. domestica* Linn. The chemicals investigated were selected on the basis of results obtained from preliminary screening tests. The physical and chemical characteristics of the chemicals have been summarized.

The third instar test larvae, 4 to 4 1/2 days old, were reared from eggs oviposited by a stock colony of the CSMA strain of house flies, *M. domestica*. The larvae were reared in constant temperature cabinets, 78°F. ± 2°F., on a medium which was a slight modification¹ of the standard CSMA house fly larval medium (Peet-Grady Method 1941). The adult stock colony was reared and maintained by the Peet-Grady technique (1941) in a room with a temperature of 80°F. to 85°F. and a R. H. of 50 to 60 percent.

Two hundred grams of the standard CSMA larval rearing media, with slight modification¹, were used for test purposes. The toxicants were added to the aqueous part (125 cubic centimeters) of the test media, and subsequently thoroughly mixed with the dry part (75 grams) of test media. Fifty test larvae per concentration duplicate or one hundred test larvae per concentration were used in each replicate. Each

chemical was replicated six times, in duplicate, at eight concentrations in geometrical progression. Therefore, in the final series of tests, each chemical was tested 96 times, with a total sample size of approximately 4,800 test larvae. Check treatments were run with all tests in order that proper adjustments (Abbott 1925) could be made for natural mortality occurring in the test treatments.

Test samples were kept in a room with a constant temperature of 78°F. ± 2°F. for a period of 14 days, at which time all larvae, surviving the lethal effects of the toxicants, had pupated, emerged as adult flies and died normally. The morphologically normal appearing flies were then counted and the rating of the chemical thus determined. The Finney (1952) method of probit analysis was used for computing the larvicidal effectiveness of the chemicals investigated in the final series of tests.

With the exception of formulations of benzene hexachloride and lindane, all chemicals investigated in the final series of tests produced an LD50 below 8.70 p.p.m. Aldrin emulsion produced an LD50 at 0.90 p.p.m. and was superior in toxicity to all chemicals investigated. EPN - 300 wettable powder and diazinon emulsion were almost as toxic as aldrin emulsion, producing an LD50 at 0.92 p.p.m. and 0.98 p.p.m. respectively. Benzene hexachloride emulsion, LD50 at 50.9 p.p.m., and benzene hexachloride wettable powder, LD50 at 121.9 p.p.m., were the least toxic of the chemicals investigated.

Of the five chemicals tested in different formulations, wettable powder, water soluble powder, and emulsions, the toxicity of the lindane formulations, wettable powder and emulsifiable concentrate, differed less than corresponding formulations of other materials. The LD50 of lindane emulsion was 11.55 p.p.m. and the lindane wettable powder was 14.80 p.p.m. The pronounced difference in the LD50 values between benzene hexachloride emulsion, 50.9 p.p.m., and benzene hexachloride wettable powder, 121.9 p.p.m., is obviously due, in part, to the difference in the percent of gamma isomers in the two formulations.

1. Sodium propionate, approximately 1/4 pound per 100 pounds of dry media was used to prevent fungus growth in test media.

111 pages. \$1.39. MicA 55-246

LYNXRUFUS WILSONI N.G., N. SP.
(NEMATODA: METASTRONGYLIDAE)
FROM THE LUNGS OF THE BOBCAT,
LYNX RUFUS RUFUS (SHREBER)

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Betty Dolores Stough, Ph.D.
Virginia Polytechnic Institute, 1953

During the late winter and spring of 1952, lungworm parasites from the bobcat, *Lynx rufus rufus*, were brought into the parasitology laboratory of the Biology Department of Virginia Polytechnic Institute for identification. The bobcats had been collected from Virginia and North Carolina and of sixty-five collected and examined twenty-five percent were found to be infected with this parasite. A thorough search through the literature did not reveal a record of lungworm parasites from the bobcat, *Lynx rufus rufus*. Further study indicated that this parasite was a new genus of the family Metastrongylidae.

The lungworms used for study were removed from lung tissue, the bronchioles and the bronchial tubes. None were found in the pulmonary blood vessels. These parasites were fixed, dehydrated in an alcohol series and placed in beechwood creosote to clear. After they had cleared sufficiently, they were mounted in permount and coverslipped. The worms were studied microscopically in detail and various structures measured with a calibrated ocular micrometer. Stippled drawings were drawn to scale of the anterior end, an en face view of the cephalic region, the posterior end of the male and the posterior end of the female. A diagram was made of the position of the female reproductive system. These drawings were photographed and photomicrographs were made of the posterior ends of the male and female worms.

In a detailed study of the family Metastrongylidae it was found that this lungworm from the bobcat, most closely resembled some of the members of the subfamily Skrjabinigylinae. From a comparative study of the genera of this subfamily, a new genus was described and this new genus of lungworm parasite, from the bobcat, designated as *Lynxrufus* with the type-species *Lynxrufus wilsoni*. This nematode was named for its host species and for Dr. I. D. Wilson, Head of the Biology Department, Virginia Polytechnic Institute.

Lynxrufus wilsoni was found to be more closely related to the genera *Bronchostrongylus* and *Troglostrongylus* than to the other genera of the subfamily Skrjabinigylinae. This resemblance was in the posterior end of the male. The three genera, all have a full complement of bursal rays, though the pattern of the lateral rays differ and the spicules of the like genera are long, delicate, and striated. There is a marked difference in the female worms. The females of *Bronchostrongylus* and *Troglostrongylus* have in common, a vulva situated toward the middle of the body, an ovejectoral apparatus and the reproductive system is arranged in a prodelphic didelphic pattern.

One of the diagnostic definitions for the subfamily Skrjabinigylinae, according to Dougherty, 1951, is the

presence of cephalic papillae. With the technique employed and the optical equipment at hand, no cephalic papillae could be discerned on the anterior end of *Lynxrufus wilsoni*.

It was concluded that *Lynxrufus wilsoni* is a newly described parasite from the lungs of the bobcat, *Lynx rufus rufus*. Further, it is a new genus of the family Metastrongylidae. The genus is named *Lynxrufus* with the type-species *Lynxrufus wilsoni*. The male of the genus *Lynxrufus* closely resembles the males of the genera *Bronchostrongylus* and *Troglostrongylus* in having a full complement of bursal rays and long, delicate spicules. The female of *Lynxrufus* differs from the females of these two genera in the position of the vulva, the lack of ovejectoral apparatus and the prodelphic didelphy of the reproductive system. Because of the similarity of the male of *Lynxrufus* to the males of *Bronchostrongylus* and *Troglostrongylus*, the genus *Lynxrufus* is placed tentatively in the subfamily Skrjabinigylinae and because of three differences between the female of *Lynxrufus* and the other skrjabins, *Lynxrufus* is thought, perhaps, to be a transitional form between the subfamily Skrjabinigylinae and some of the other subfamilies of the family Metastrongylidae.

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MIRABILIS NYCTAGINEA (MICHAUX)
MacMILLAN AND CERTAIN INSECTS
AS A MICROCOMMUNITY

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Clifford Wester, Ph.D.
University of Illinois, 1954

The wild four-o'clock plant, *Mirabilis nyctaginea* (Michaux) MacMillan, is the center around which is formed a microcommunity of certain insects. At least four species of these are phytophagous, and seem to have adapted their life habits more or less to coincide with the yearly growth and development of the plant. These phytophagous insects are: (1) the stem-borer sun moth, *Heliodines ionis* Clarke, (Lepidoptera, Heliodinidae) whose larvae are borers in the stems of the host plant; (2) the leaf-skeletonizer sun moth, *Heliodines nyctaginella* Gibson, (Lepidoptera, Heliodinidae) whose larvae feed on the leaves of the wild four-o'clock; (3) the four o'clock snout beetle, *Onychobaris subtonsa* Leconte, (Coleoptera, Curculionidae) whose larvae are borers in the stems of the host plant; and (4) the four-o'clock bug, *Catorhintha mendica* Stal, (Hemiptera, Coreidae) whose adults and nymphs feed on the leaves and involucres of the plant.

There are at least seven species of hymenopterous parasites that feed on the phytophagous insects. Three of these are braconids, and four are chalcids. Of the braconids, *Apanteles* sp. (Hymenoptera, Braconidae) is a solitary endoparasite of the larvae of *Heliodines nyctaginella*, *Bracon caulicola* (Gahan), (Hymenoptera, Braconidae) is a solitary ectoparasite

on the larvae of Heliodines ionis and of Onychobaris subtonsa, and Bracon gelechiae Ashmead (Hymenoptera, Braconidae) is a solitary ectoparasite on the larvae of Heliodines nyctaginella.

Of the chalcids, Eupelmus allynii (French) and E. cyaniceps Ashmead (Hymenoptera, Eupelmidae) are solitary ectoparasites on the larvae of Heliodines ionis, Tetrastichus coerulescens Ashmead (Hymenoptera, Eulophidae) is a gregarious

endoparasite of the pupae of Heliodines ionis, and Neocatolaccus tylodermae (Ashmead) (Hymenoptera, Pteromalidae) is a solitary parasite of the larvae of Onychobaris subtonsa.

One species of the microcommunity is a predator. This insect is the insidious flower bug, Orius insidiosus (Say) (Hemiptera, Anthocoridae). It preys on the smaller larvae of Heliodines nyctaginella.

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AUTHOR INDEX

- ADAMS, Harold Willard. Tomato juice film deposition on heat exchanger coils. 105
- AFFSPRUNG, Harold Edwin. The use of ion exchange resin membrane electrodes in the study of the inorganic equilibria of milk. 23
- AFTANDILIAN, Victor Daniel. Observations on the rare earths: I. Preparation of anhydrous nitrates. II. Electrochemical studies in anhydrous ethylenediamine. 30
- AGOGINO, Mercedes Merner. An experiment on the time variations of cosmic rays underground. 137
- ALBERT, Waco Worthy. The utilization of varied sulfur sources in urea containing rations fed to lambs. 3
- ALBRECHT, Andreas Christoph. Excited electronic states in N,N,N',N'-tetramethyl-p-phenylenediamine and p-dimethoxybenzene. 46
- AL-YOUSEF, Abdul Qadir Ahmad. A study in the liberative movement of Iraq, 1908-24. 109
- ANDERSON, JR., William Strong. An investigation of reading achievement as an affective determinant in the perception of verbal and non-verbal symbols. 81
- ARMSTRONG, Maurice Ray. The rates of alkaline hydrolysis of some β -diethylaminoethyl esters related to procaine. 37
- ATE, JR., Louis Clyde. Differential effects of anxiety on the use of pattern and intensity cues in concept formation tasks. 149
- AZHAR, Barkat Ali. A consideration of the factors conditioning the economic development of Pakistan. 51
- BADRAN, Mostafa Kamel. A comparison of conceptions of the role of the teacher of vocational agriculture. 91
- BAILEY, June Dudley. Coleridge's revisions of *The Friend*: a study of his thought and method. 120
- BALL, George E. A taxonomic study of the North American Licinini with notes on the old world species of the genus *Diplocheila* Brulle. (Coleoptera: Carabidae) 172
- BALTHAZAR, Earl Edward. The influence of permissive child rearing practices on personality development. 82
- BARKER, Lucius Jefferson. Offshore oil politics: a study in public policy making. 145
- BARON, Bertha. A phytochemical study of matarique. 132
- BARTKIEWICZ, Stanley Anthony. I. A new ruby glass for the protection of chemical systems sensitive to light and high energy radiation. II. A critical analytical chemical study of light activated flavor in milk. III. An x-ray diffraction and electron microscopic study of positive lead storage battery plates. 22
- BASS, JR., Frank Myron. A study of functional relationships in drug store expense and margin. 53
- BEACOM, Seward Elmer. The photochemical reactions of some transition metal complexes. 31
- BERESNIEWICZ, Alexander. Interaction of polyamides with acids and bases. 46
- BERNSTEIN, Benjamin. Extinction as a function of frustration drive and frustration stimulus. 152
- BLACKMAN, Leonard S. The effects of personality and group oriented feelings of success and failure on aspirational shifts. 82
- BLATNIK, William Henry. Patterns of staff organization in community unit districts. 67
- BLOUSTEIN, Edward Jerome. The legal philosophy of Hans Kelsen. 135
- BORENSTEIN, Walter. Pio Baroja: his contradictory philosophy. 121
- BOUNOUS, Lyle Galen. A survey of the effects of the Missouri School District Reorganization Law of 1948 upon the high school program. 60
- BOWERS, David R. Changes in non-advertising content of two selected groups of newspapers subscribing to Teletypesetter circuit operation. 115
- BOYD, William Adam. Effect of diet and chronic dehydration on resting metabolism and metabolism of passive exercise in man. 142
- BROWN, John Fanton. Effect of various freezing temperatures on the behaviour of the strawberry plant. 13
- BROWN, Francis Robert. The effect of an experimental course in geometry on ability to visualize in three dimensions. 83
- BROWN, JR., Walter Charles. Hiring, advancement, and training practices in selected St. Louis area industries. 79
- BRUN, William Alexander. Translocation of the flowering effect in photoperiodically induced plants. 13
- BULL, Galen William. The activities and backgrounds of pupils with dominant science interests. 61
- BURLESON, Charles Elton. The development of procedures and materials for study and revision of the science curriculum in secondary schools. 61
- BUSCH, Daryle Hadley. The stereochemistry of complex inorganic compounds: I. Application of the chelate effect to stereochemical problems. II. The relationships of infrared spectra of complex inorganic compounds to their stereochemical features. 31
- CARTER, Leslie Guy. State school board associations in twelve selected states. 69

- CASEY, James Joseph. A study of the distribution of trace elements between molten and solid salts using radioactive tracers. 32
- CHANG, Richard Chi-cheng. Physical chemistry of fire fighting foam and foaming agents: Phase I: Studies on bubble sizes and bubble size distribution. Phase II: Studies on the behavior of single films. 47
- CHEN, Ling. A pharmacognostical study of valerian. 133
- COATES, JR., Clarence Leroy. Excitation processes in DC discharges in neon-argon mixtures. 100
- COCHRAN, John Francis. The superconducting transition in pure aluminum. 137
- COE, JR., Edward Harold. Anthocyanin synthesis in maize: genetic and biochemical effects of the factors A_1 , A_2 , and Bz. 14
- COOK, Paul LaVerne. Alkylations with quaternary salts of 2-aminomethylindoles. 37
- CORLEY, Robert Elson. A sociological evaluation of some urban planning programs. 158
- CORNMAN, JR., Wilmer Ray. Chemical effects of the nuclear reaction $N^{14}(n,p)C^{14}$ in crystalline ammonium sulfate and beryllium nitride. 47
- CUMMINGS, Jonathan Walkley. The effect of electric shock upon duration of alpha block induced by visual stimuli. 152
- CURRIER, James William. Compounds of high nitrogen content derivatives of 5-aminotetrazole. 32
- D'AGUANNO, William. Some effects of a partially purified toxin of *Micrococcus aureus* on chicken erythrocytes. 143
- de CASTRO, Natividad Feliciano. Analysis of acorn oil. 44
- DIAMOND, Louis Harold. Derivatives of hydrazine: I. Preparation of n-substituted hydrazines. II. Chemistry of triamino-guanidine. 33
- DICKSON, John Thomas. Effects of hypnotically induced emotional states, difficulty of task and anxiety on psychomotor behavior. 149
- DYER, John Robert. The chemistry of neamine. 23
- EICHHORN, Robert Lee. Patterns of segregation, discrimination and inter-racial conflict: analysis of a nationwide survey of intergroup practices. 163
- EISEN, Henry. The preparation and physicochemical studies of the metallic salts of ursolic acid. 45
- EL-HIFNI, Mohamed Alaeldin. A quasi-steady method of measuring thermal diffusivity of metals at elevated temperatures. 103
- ELLIS, Brobury Pearce. Creative relationships between dramatist, actor, and audience in the acted play. 164
- EMMERLING, Margaret Helen. An analysis of ultraviolet and x-ray radiation on chromosomes of *Zea mays*. 12
- ETTER, James Edgar. Faraday rotation of electromagnetic waves in waveguides containing gaseous discharge plasmas with applied longitudinal magnetic fields. 100
- EUSTON, Charles Buford. The high pressure oxidation of the system nitroethane-95% nitric acid. 48
- EVERETT, Edward George. Pennsylvania's mobilization for war, 1860-1861. 110
- FANG, Fabian Tien-Hwa. The conjugate addition of t-butylmagnesium chloride to o-hydroxy diaryl ketones. 38
- FAUST, JR., John William. The accommodation coefficients of the inert gases on aluminum, tungsten, platinum, and nickel and their dependence on surface conditions. 49
- FERGEN, Geraldine Katharine. Listening comprehension at controlled rates for children in grades IV, V, and VI. 89
- FERGUSON, Oliver Watkins. The Irish writings of Jonathan Swift. 121
- FIELDER, JR., Gordon Wesley. The development and appraisal of materials and procedures for building parent-teacher consensus regarding cooperative school improvement. 62
- FISCHER, Robert Leigh. Insulin-metal complexes. 24
- FISHER, Hans. Nicotinic acid and tryptophan metabolism in the chick. 3
- FLANNIGAN, Norman Anthony. A study of high school science courses in grades 9-12 designed for general education. 62
- FOOTE, Murray Wilbur. Phosphoprotein phosphatase in the chick embryo. 25
- FRAD, William Alfred. Carbon monoxide attack of refractories. 94
- FRENCH, Ellery Walter. Vitamin requirements and some aspects of unknown factors in the development of the confused flour beetle, *Tribolium confusum* Duval. 172
- FRIEDLANDER, Sheldon Kay. Deposition of aerosol particles from turbulent gases. 95
- FRIEDMAN, Robert Phillip. The public speaking of Arthur M. Hyde. 165
- FROST, JR., Orcutt William. The early life of Lafcadio Hearn. 122
- FUKUI, Henry Nobuyoshi. The applications of paper partition chromatography to identify off-flavor and odor constituents in stored dehydrated pork. 25

- GALUN, Arjeh Baruch. Polymerization and copolymerization of ethylenic ketones. 38
- GARBER, Meyer. The effect of pressure on the superconducting transition of tin. 137
- GARD, Don Irvin. Unidentified factors in swine nutrition. 4
- GHOSH, Gouri Rani. Comparative physiology of some members of the Gymnoascaceae. 15
- GILL, Stanley Jensen. The effect of pressure on the electrolytic properties of solutions: A. Conductance of polyelectrolytes under pressure. B. Transference numbers of electrolytes under pressure. 50
- GOBERDHAN, Cecil Kunar. A study of the inorganic constituents in the blood and urine of dairy cows under thermal stress and radiation. 26
- GOLDBERG, Kalman. An analysis of the production relations of a medium size manufacturing plant. 58
- GOLDEN, Joseph. The position and character of theater-in-the-round in the United States. 166
- GOODMAN, Donald Charles. Functional anatomy of the feeding apparatus in waterfowl (Aves: Anatidae). 173
- GOODSON, Felix E. Secondary reinforcing and motivating properties of stimuli contiguous with shock onset and termination. 153
- GOSE, JR., Elliott Bickley. *Passion And The Tradition: a critical appraisal of Ford Madox Ford.* 123
- GRAHAM, Martha E. Calculation of laminar boundary layer flow on rotating blades. 94
- GREEN, Leon Grant. A plan for the administration of recreation in the state of Idaho. 80
- GREER, Virginia Leonard. Charles Evans Hughes and Nicaragua, 1921-1925. 111
- GUSTAFSON, John Alfred. A study of those extra-curricular activities which contribute to nature and conservation education in certain liberal arts colleges. 63
- GUTTMAN, Newman. Experimental studies of the speech control system. 166
- HALL, Robert Collier. A study of the relationships among certain occupational groups in performance on the Differential Aptitude Test battery. 84
- HAMMACK, James Alan. *Pope's Theatre and St. Louis theatrical history: 1879-1895.* 167
- HAMMER, Robert Nelson. Some electrochemical studies of chloramine and hydrazine. 34
- HANKINS, Joe D. Metric characterizations of elliptic n-space. 129
- HARDENBERGH, William Spencer. British government in British Columbia. 145
- HARRIS, Leonard Andrew. The effect of edge conditions on the tendency toward brittle fracture of structural steels. 98
- HAVERLAND, Edgar Marion. The application of an analytical solution for proportional profiles rotation to a box problem and to the drive structure in rats. 153
- HEATON, LeRoy. The crystal structure of manganese antimonide. 138
- HECK, Walter Webb. The metabolism of several oximino compounds by plant tissues. 15
- HOLLAND, Laura Virginia. Aristotelianism in the rhetorical theory of Kenneth Burke. 168
- HOLMES, Francis William. The Dutch elm disease as investigated by the use of tissue cultures, antibiotics, and pectic enzymes. 6
- HOLONYAK, JR., Nick. Effect of surface conditions on characteristics of rectifier junctions. 101
- HOOD, James Frederick. The privy council under the early Tudors. 112
- HOOVER, Charles Robert. Studies on *in vitro* metabolism of the rat mammary gland and some observations on *in vitro* actions of thyroid hormones. 27
- HOUSE, Robert William. A proposed curriculum for preparing teachers of music at Kearney State Teachers College. 89
- HURST, Robert Lee. Consumer buying habits in selected areas of St. Louis, Missouri. 54
- HUTTON, JR., Charles Lee. A psychophysical study of speech rate. 168
- IWAHARA, Shinkuro. A quantitative study of learning in the runway as a function of hours of food deprivation. 153
- JASPER, Arthur William. Merchandising fresh fryers in service meat departments in supermarkets. 52
- JENKINS, Owen. The art of history in Renaissance England: a chapter in the history of literary criticism. 123
- JENSEN, Leo Stanley. Investigations on an unidentified growth factor in grass juice required by chicks and poults. 5
- JOHNK, Carl Theodore Adolf. Synthesis of aperture antennas. 101
- JONAS, Edward Charles. The reversible dehydroxylation of three-layer clay minerals. 106
- JONES, Dallas Lee. The Wilson administration and organized labor, 1912-1919. 108
- KATZENSTEIN, Henry Sour. An electron impact study of boron trifluoride with a time-of-flight mass spectrometer. 138
- KE, Ke-Chuan. The synthesis of methionic acid derivatives of nitrogen heterocyclic and related compounds. 133

- KEENAN, Thomas Kent. Exchange reactions of the transuranium elements. Section I. Am(III)-Am(V)-Am(VI), Am(III)-Am(V), and Am(V)-Am(VI). 34
- KERN, Donald Warren. The prediction of academic success of freshmen in a community college. 85
- KIRKPATRICK, Arthur Roy. Missouri, the twelfth Confederate state. 109
- KLOS, Edward John. Ring spot and yellows of cherry: orchard spread, injurious effects on the trees, symptom expression on different varieties, and influence of tree nutrition and light on disease development. 6
- KNEIP, Theodore Joseph. A study of the electroreduction and adsorption of N,N-dimethyl-p-phenylazoaniline at a mercury surface. 35
- KNOLL, Marjorie May. Economic contributions given to and received from individual members of families and households in relation to their financial situation. 114
- KNOX, Ellis Gilbert. The bases of rigidity in fragipans. 1
- KODMAN, JR., Francis. An investigation of word intelligibility as a function of time compression. 169
- KRIMEN, Lewis Irvin. The conjugate addition of t-butylmagnesium chloride to cinnamaldehyde and α, β, β -triphenylacrylophenone. 39
- KUEHN, Harold Herman. Comparative morphology of the Gymnoascaceae. 16
- LANDSBERGER, Henry Adolf. A study of mediation through an analysis of the background of disputes and the activities of the mediator. 156
- LANE, Franklin Charles. The genus *Triosteum* (Caprifoliaceae). 17
- LAWSON, Edwin David. Attitude shift as related to palmar sweating in group discussion. 154
- LEASMAN, Rudolf Eugene. The relation of the pattern of high school courses to college success. 70
- LEE, William Wei. Studies in allylic systems: 1-(chloromethyl)-cyclohexene, its preparation and reactions. 39
- LENN, Theodore I. Social stratification and the educative process: an experimental study in pre-service teacher education. 159
- LEPPER, JR., Robert. The centrosome in the Hepaticae and the centrosome-blepharoplast homology. 17
- LICHTON, Ira Jay. Interrelationships between the kidneys and eccrine sweat glands of man in their electrolyte and total osmotic excretions. 143
- LICHTWARDT, Robert William. Morphological, cytological, and taxonomic observations on species of *Enterobryus* from the hindgut of certain millipeds and beetles. 17
- LIN, Mei. Chromosomal control of nucleolar composition in maize. 18
- LIVINGSTON, John. Bank reserve requirements and how their effectiveness as an instrument of monetary control may be enhanced. 55
- LOCKE, David Millard. I. Aromatization studies on six- and seven-membered heterocyclic rings. II. Unsaturated amines: diagnosis of double bond position by ultraviolet absorption spectra. 40
- LONG, Calvin Lee. The metabolic fate of 3-hydroxyanthranilic acid. 27
- MacDONALD, John Angus. I. A synthesis of tryptophan and tryptophan analogs. II. The sulfur-containing products of the reductive cleavage of sulfonamides. 41
- MACMILLAN, Allister Miles. Explorations in rural community health, with particular reference to psycho-physiological symptoms. 157
- MAGOUN, Creighton Francis. A measure of the ability of certain selected Connecticut communities to support public education. 71
- MANIS, Melvin. Social interaction and the self concept. 147
- MARKLEY, James Gerald. The verbal categories of substandard Spanish. 118
- MARTIN, Fred Eli. The preparation of some physiologically active compounds containing two nitrogen atoms. 42
- MARTIN, James Bruce. Phytase and phosphorus distribution in alfalfa. 45
- MATLACK, Charles William. Leopoldo Alas and naturalism in the Spanish novel, 1881-1892. 124
- MATTICK, Leonard Robert. Quantitative determination of antibiotics in milk. 1
- MAX, Herbert John. The development of an instrument to measure an aspect of critical thinking in the area of high school chemistry. 64
- McCOY, Raymond Arthur. Stability and change of measured vocational interests of high school students. 85
- McENTYRE, John Gerald. A suggested revision of the laws of Kansas regulating land surveying and land registration. 99
- McNEILL, William Duncan Davidson. Developmental patterns of mongoloid children: a study of certain aspects of their growth and development. 86
- MEHL, Bernard. The high school at the turn of the century: a study of the changes in the aims and programs of public secondary education in the United States, 1890-1900. 78

- MELROSE, Jay. The temporal course of changes in the amount of vocal disturbance produced by delayed auditory feedback. 169
- MERLINI, Alfonso. Study of the origin of annealing textures in copper and alpha brass. 104
- MERRILL, Irving Rodgers. Campaign expenditures and their control: a study of expenditures for television time in the 1952 federal election. 115
- MEYER, Conrad Frederick. The embryogeny of the McIntosh apple. 19
- MIECZKOWSKI, Bogdan. Communist money and banking: the Polish case. 56
- MILANO, Joseph Ernest. A study of the application of machine breakdown analysis as a method for determining instructional content for training machine maintenance men. 76
- MILLER, Patrick Martin. The effect of certain metabolites and fungicides on *Stemphylium* Spp. 19
- MILLON, Theodore. The role of situational variables in perceptual behaviors characteristic of authoritarians. 147
- MITCHELL, Helen deRamus. A study of selected interaction experiences among a group of citizens conducting a study of their Citizens' Committee activities. 77
- MITCHELL, John Boyd. The social and economic aspects of chronic illness in rural Missouri. 160
- MOELLERING, William Marshall. The effect of the structure of the proton on the hyperfine interaction in hydrogen. 140
- MOHANTY, Gajendra Nath. An investigation of the characteristics of high alumina refractory castables. 95
- MOORE, Alfred Henry. Practices and opinions relative to practical arts education for mentally retarded secondary school youth. 91
- MORGAN, Thomas Nolen. Photoconductivity in germanium at liquid helium temperatures. 139
- MOSELEY, William Whatley. An etymological vocabulary of the Spanish in the works of Gil Vicente. 119
- MOSS, Sidney Phil. Poe's literary battles. 125
- MOULD, Richard Everett. Superconductivity of a precipitation hardening aluminum alloy. 140
- MUELLER, Iris Wessel. Mill and French thought: being a study of the influence of French thought on the development of John Stuart Mill's political and social philosophy. 136
- MUKA, Arthur Allen. The biology of the clover head weevil, *Tychius stephensi* Schoenherr, with some notes on control. 12
- MUNVES, Elizabeth Ann Douglass. A comparison of the effectiveness of two methods of influencing certain obese college students to attain and maintain "ideal" weight. 107
- NELSON, Jack Loren. Zinc sorption and release by soils and clays. 2
- NELSON, Leonard Carl. Generalized pVT properties of gases. 103
- NEWKIRK, Elaine Francine Charlotte. La renommée littéraire de Marceline Desbordes-Valmore (1820-1950). 125
- OFFUTT, Marion Samuel. Inoculation studies as related to breeding for resistance to bacterial wilt in lespedeza. 7
- OSTERYOUNG, Robert Allen. Electrochemistry in fused salt media. 36
- PANDAZI, Andrew A. Estimation of total body water and state of hydration in man. 143
- PARKES, Ernest. An investigation of the relationship between some aspects of parent-child interpersonal living and opinions in the offspring. 150
- PEAKE, Burton Howard. Identification of major needs of Vermont youth in high school grades 10, 11, and 12. 65
- PERLIS, Irwin Bernard. Auxin and anti-auxin-induced changes in the utilization of C¹⁴ labeled acetate and pyruvate by plant tissues. 20
- PERRY, JR., Benjamin Luther. Alternative economic opportunities on the land for Negro Veteran Institutional On-The-Farm Trainees in the general farming area of Northwest Florida. 52
- PHILIPP, Herbert Reynold. Photoelectric emission from barium oxide. 140
- PLOCH, Louis Albert. Factors related to the formal social participation of twenty-six selected rural persons — with case studies. 160
- PORTZ, Herbert Lester. Variation in cyanophoric properties of white clover (*Trifolium repens* L.). 8
- POTTER, Robert Elmer. The role of the school in a transitional society. 78
- POWELL, Edson Boyd. Analysis of the incidence and cost of non-promotions in the public elementary schools of third class districts in Pennsylvania. 71
- POWELL, Victor Morgan. A rhetorical criticism of the speeches of Herbert Spencer Hadley. 170
- PRICE, Granville. An analysis of methods for measuring newspapers' coverage of presidential election campaigns. 116
- PUNNETT, JR., Thomas R. Cell-free extracts of unicellular algae. A study of preparative techniques and reaction components. 28
- RADNER, Louis. The role of proprioceptive cues in conditioning. 155
- RAYNER, Samuel Alan. The administration of pupil personnel services: a comparative study of services in the United States and Queensland, Australia. 72

- RETTAN, Earl Aaron. The economical reform movement in England, 1780-1788. 57
- REMES, Nathaniel L. The effect of substituents on the catalytic hydrogenolysis of benzylamines. 42
- RODGERS, Leland Thorpe. Characteristics of junior college women having personal problems hindering adjustment. 87
- ROGERS, JR., James Lloyd. A study of prospective high school teachers' attitudes toward daily newspapers and freedom of information. 117
- ROMANO, John Emilio. Spectrum of turbulence in axisymmetric flow. 96
- ROSEN, William G. On invariant means over topological semigroups. 129
- ROWAN, Thomas Churchill. Some developments in multidimensional scaling applied to semantic relationships. 148
- SANJEAN, John. Taxonomic studies of *Sarcophaga* larvae of New York with notes on the adults. 11
- SCHEY, Harry Moritz. Meson contributions to nucleonic Compton scattering. 141
- SCHMIDT, JR., Hans. Response stereotypy and retroactive inhibition. 155
- SCHMOLL, Joseph Benjamin. An analytical study of the principal instrumental compositions of Wallingford Riegger. 130
- SCHOENGOOD, George Jay. The organization and administration of public recreation in the State of New York. 73
- SCHOOLING, Herbert Woodrow. The use of lay citizens advisory committees in selected Missouri public schools. 74
- SCHOTTENHAMEL, George Carl. Lewis Baldwin Parsons and Civil War transportation. 112
- SCHRIEBER, Marvin Mandel. An evaluation of herbicidal materials and their effects on the yield and botanical composition of forage legumes with special reference to the control of yellow rocket, (*Barbarea vulgaris*). 8
- SCHUMAIER, Clarence Peter. An analysis and evaluation of the grain marketing system in southern Illinois. 54
- SENSING, Welton Jerry. The policies of Hernán Cortés, as described in his letters. 126
- SHEN, Chung Yu. Reaction kinetics in fluidized beds. 97
- SHEPARD, John William. Principles of method in group string instrument instruction. 92
- SHULMAN, Milton Davis. Analysis and interpretation of a long-time soil fertility experiment in southern Illinois. 9
- SILVERNAIL, Walter Lawrence. The thermal accommodation of helium, neon, and argon on clean tungsten from 77° to 303°K. 50
- SINFELT, John Henry. The effect of molecular properties on interfacial resistance. 98
- SOHL, Norman Frederick. The gastropods of the Late Cretaceous Ripley, Owl Creek, and Prairie Bluff formations. 106
- SOUERWINE, Andrew Harry. Relationships between parents and sons on authoritarianism. 157
- SPAIN, William Thomas. Sulfonamide derivatives of benzo(h)quinoline. 134
- SPIVEY, Ted Ray. Two visions of character and fate: a study of themes and major characters in the novels of Thomas Hardy and George Eliot. 127
- STANDIFER, Lonnie Nathaniel. Laboratory studies on the toxicity of selected chlorinated hydrocarbon and phosphate chemicals to third instar larvae of the house fly, *Musca domestica* Linn. 174
- STARKEY, Willard A. The history and practice of ensemble music for lip-reed instruments. 131
- STOUGH, Betty Dolores. *Lynx rufus wilsoni* N.G., N. SP. (Nematoda: Metastrongylidae) from the lungs of the bobcat, *Lynx rufus rufus* (Shreber). 175
- SUSLOW, Leo Arthur. Social security in Guatemala: a case study in bureaucracy and social welfare planning. 163
- SUTHERLAND, Alan Duryea. Large signal theory on the parallel plane triode. 102
- SWANSON, Roy Arthur. *Pudor* as a criterion in Latin literature. 118
- SYMPSON, Robert Frederick. I. Amperometric titration of calcium with the disodium salt of ethylenediaminetetraacetic acid. II. A study of the adsorption and electroreduction of fumaric and maleic acids on metal surfaces. 36
- TABLER, Kenneth Ambrose. Selection indices based on milk and fat yield, fat per cent, and type classification of dairy cattle. 5
- TANGRI, Krishan Kumar. A study of the deformation texture and its variation in cold drawn nickel rods. 104
- TERRY, JR., Roscoe Linn. Business practices in Missouri public schools. 74
- THEODORSON, George Achilles. The structure and development of social cohesion. 161
- THOMAS, Paul David. The desaturation of sparteine and related model amines. 43
- THOMPSON, Willard Mead. A manual of retail salesmanship. 66
- THURMAN, Bedford. Stark Young: a bibliography of his writings with a selective index to his criticism of the arts. 170
- TIMMEL, Gustave Bernhardt. A study of the relationship between methods of teaching a college course in mental hygiene and change in student adjustment status. 90

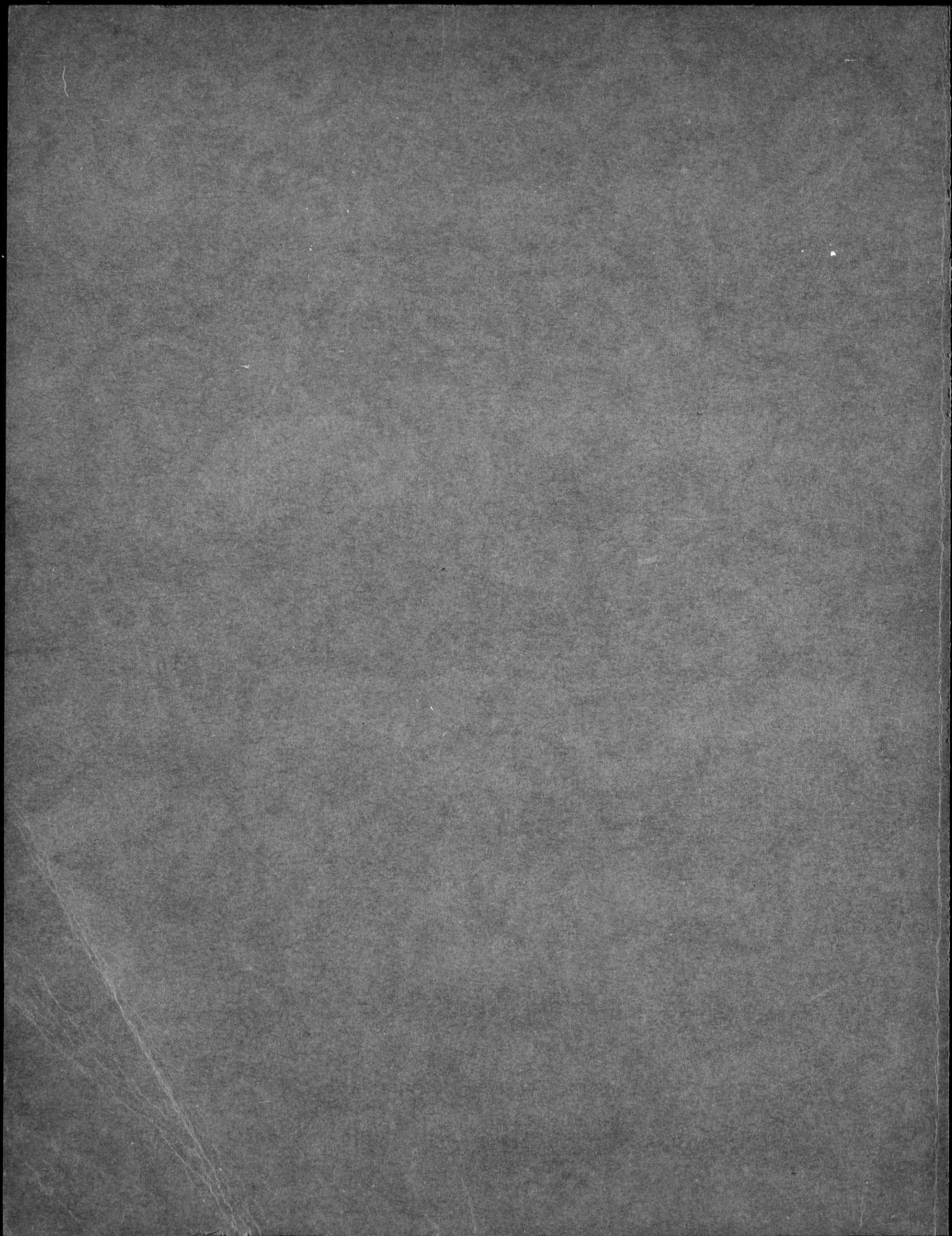
AUTHOR INDEX

183

- TOMSOVIC, Milan. The effect of anoxia upon learning and reversal of a position habit in the white rat. 151
- TREAT, JR., Jay Emery. The spatial distribution of nuclear disintegrations in photographic emulsions exposed to cosmic rays. 141
- TREMBLAY, Marc-Adelard. The Acadians of Portsmouth: a study in culture change. 162
- TRESCOTT, Paul Barton. Federal finance and the American economy, 1790-1860. 58
- TUNIS, Marvin. Studies of fructokinase in fructose absorption. 29
- ULLREY, Duane Earl. Reproductive performance of the sow: normal fetal development and the need for certain vitamins. 10
- VAN BUREN, Jerome Paul. Glucose dehydrogenase. 29
- VAN DEWATER, Charles John. The effects of Federal fiscal programs on economic activity. 56
- WANG, Chi-Tao. A phytochemical and pharmacological study of matarique. 135
- WEIDEN, Mathias H. J. An introduction to acetate metabolism in insects: the fate of sulfanilamide and of several N-acetylated arylamines in the roach. 144
- WESTER, Clifford. *Mirabilis nyctaginea* (Michaux) MacMillan and certain insects as a microcommunity. 175
- WESTER, Louise Hatch. A structural analysis of the epic style in the *Cid*. 120
- WIEGERT, Philip Erwin. The action of Grignard reagents on β -benzopinacolones. 44
- WILKEN, Robert Leo. Father Anselm Weber, O.F.M., missionary to the Navaho, 1898-1921. 113
- WILLIAMS, John Edward. The World And God: the poems and dramas of Fulke Greville. 127
- WIRTZ, Morvin Albert. An exploratory study of a parent-sponsored day school for severely mentally retarded children. 88
- WOODBURY, Lael Jay. Styles of acting in serious drama on the nineteenth century American stage. 171
- WORTH, George John. Maupassant in England. 128
- WRIGHT, Lawrence Sydney. Relation of units taken and marks earned in high school subjects to navy school achievement. 67
- WRIGHT, Oscar. The formulation of a resource unit of teaching aids for the industrial arts woodworking shop on the high school level in New York City. 93
- YOUNG, Harold Lloyd. A proposed financial plan for state support and distribution to the public schools in Missouri. 75
- ZIMERMAN, David. Ammonium and nitrate nitrogen absorption by young apple trees in soil or artificial nutrient media of varying acidity. 10
- ZUCKERMAN, Bert Merton. Effects of ionizing radiations, ultrasound, and several chemicals on the oak wilt fungus. 21







DISSERTATION ABSTRACTS

Volume XV, No. 2

1955